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The Academy of Management JOURNAL

Special Research Forum: Human Resource Management and Organizational Performance

rticles

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FROM THE EDITOR

As I sit here writing this, I am within a few days of the end of receiving new manuscripts. Although I will continue to work with revisions until the end of the year, July 15 marks the beginning of the transition to Anne Tsui's editorship. Although there are surely aspects of this job that I will miss, I must admit to feeling that a great weight is being removed from me as well. I'll have some observations on my term as editor in a later issue.

For now, though, I wanted to point out a few things about this issue and recognize an outstanding paper. First the recognition. Bruce Meglino once again chaired the committee to select the Best Paper in *AMJ* for 1995. His committee consisted of Ed Conlon, Dan Dalton, Sara Rynes, and Ken Smith. They worked through a large number of excellent papers and finally found a winner. I am especially pleased to announce that the winner of the Best Paper Award for 1995 was Mark Huselid, "The Impact of Human Resource Management Practices on Turnover, Productivity, and Corporate Financial Performance." The paper appeared in the August 1995 issue. Mark is on the faculty here at the School of Management and Labor Relations at Rutgers University, but I had nothing to do with his winning—I don't even vote!

Speaking of Mark's paper, the present issue includes a Special Research Forum on HRM and organizational performance, with Brian Becker and Barry Gerhart serving as guest co-editors. There are a number of excellent papers here, and this forum should have a great impact on future research in this area.

This issue also includes the first paper that was published primarily as a comment on an earlier paper. The Van De Vliert and Van Yperen paper raises some questions about the conclusions reached by Peterson et al. (*AMJ*, 1995, vol. 38, pp. 429–452) concerning the causes of role overload. Although the paper was largely written as a comment on the earlier paper, it goes beyond simple arguments and actually presents some different perspectives on the role of contextual variables in cross-cultural research. I should note that Mark Peterson and his colleagues have been invited to present a response. All in all, this should be particularly interesting issue.

Angelo DeNisi

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THE IMPACT OF HUMAN RESOURCE MANAGEMENT ON ORGANIZATIONAL PERFORMANCE: PROGRESS AND PROSPECTS

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We describe why human resource management (HRM) decisions are likely to have an important and unique influence on organizational performance. Our hope is that this research forum will help advance research on the link between HRM and organizational performance. We identify key unresolved questions in need of future study and make several suggestions intended to help researchers studying these questions build a more cumulative body of knowledge that will have key implications for both theory and practice.

A rapidly changing economic environment, characterized by such phenomena as the globalization and deregulation of markets, changing customer and investor demands, and ever-increasing product-market competition, has become the norm for most organizations. To compete, they must continually improve their performance by reducing costs, innovating products and processes, and improving quality, productivity, and speed to market. With this Special Research Forum on Human Resource Management and Organizational Performance, we hope to contribute to a better understanding of the role of human resource decisions in creating and sustaining organizational performance and competitive advantage.

The conceptual and empirical work relevant to this question has progressed far enough to suggest that the role of human resources can be crucial (Arthur, 1994; Cutcher-Gershenfeld, 1991; Huselid, 1995; Huselid & Becker, 1996; Gerhart & Milkovich, 1990; Ichniowski, Shaw, & Prennushi, 1994; MacDuffie, 1995). However, given the importance and complexities of the issue, this body of work is relatively small, and most of the key questions are sorely in need of further attention. We hope that the publication of this special forum will encourage and reinforce interest in this area, as well as

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The authors contributed equally and are listed in alphabetical order.

We thank Lee Dyer, Mark Huselid, Susan Jackson, Charles Trevor, and Patrick Wright for comments on an earlier version of this article.

help researchers in their decisions regarding what to study and how to study it. We also hope that it will demonstrate to senior human resources (HR) and line managers that their HR systems represent a largely untapped opportunity to improve firm performance.

How do human resource decisions influence organizational performance? In the simplest terms, they must either improve efficiency or contribute to revenue growth. Human resources, both as labor and as a business function, has traditionally been viewed as a cost to be minimized and a potential source of efficiency gains. Very seldom have HR decisions been considered a source of value creation, or what Hamel and Prahalad (1994) termed "numerator management." Labor costs continue to be the single largest operating cost in many organizations (Saratoga Institute, 1994), and reductions in employment continue to be a major aspect of strategies to restructure operations and reduce these costs (e.g., Uchitelle & Kleinfield, 1996). Do these decisions create value, or just reduce costs? Empirically, the challenge is to distinguish between staffing reductions that are purely cost-cutting measures and restructurings that require fewer employees but create value because the new structures are more appropriate for the firms' particular strategies. The positive stock market reactions to employment reductions reported in Davidson, Worrell, and Fox (this issue) are consistent with both interpretations.

The new interest in human resources as a strategic lever that can have economically significant effects on a firm's bottom line, however, aims to shift the focus more toward value creation. This new perspective, addressed by special issues and forums in this journal and in others (*Industrial Relations, Journal of Accounting and Economics*), suggests that HR (both the function and the system) contributes directly to the implementation of the operating and strategic objectives of firms.[1] This new strategic role for HR has attracted interest in the subject beyond the traditionally narrower boundaries of human resource research. The strategic approach draws heavily on psychology, economics, finance, and strategy, and we feel that the best research will likely come from taking an interdisciplinary focus.

Reflecting this multidisciplinary interest, the mechanisms by which human resource decisions create and sustain value are complicated and not well understood. Early efforts, such as utility analysis, sought to quantify the dollar value of improvements in employee selection and other human resource activities (Boudreau, 1992; Brogden & Taylor, 1950; Cascio, 1991; Schmidt, Hunter, McKenzie, & Muldrow, 1979). However, these estimates typically have rather broad confidence intervals (Alexander & Barrick, 1987) and are not always as robust as one would like in the face of changes in assumptions (e.g., those regarding the standard deviation of performance in dollars). Moreover, there is some doubt regarding whether managers' decisions are particularly responsive to information about the estimated dollar value of alternative decisions, especially as the estimation procedures become increasingly complex and difficult to understand (Latham & Whyte, 1994).

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[1] Indeed, it can be argued that this is one of the remaining core roles left for HR in organizations as much of the transactional work of the HR function is outsourced (Corporate Leadership Council, 1995).

Empirical research on the subject of this special forum will likely encounter some similar obstacles in making the translation from research to policy implications. However, a potential advantage in this respect is that most of the papers herein look directly at the impact of HR decisions on performance outcomes that have clear meaning and relevance to managers, such as stock performance, productivity, profits, quality, and organizational survival. In addition, this research suggests that HR can go beyond its traditional organizational role to become a strategic partner in most organizations. The subject of this special forum should be of equal interest to senior line executives and senior human resource executives. Indeed, creating this strategic impact very likely requires a system focus and a degree of attention to alignments both within HR systems (internal fit) and with operating and strategic objectives (external fit) that necessarily involves a closer relationship between HR and line managers.

In the remainder of this article, we review theoretical work suggesting that an HR system can be a unique source of sustained competitive advantage, especially when its components have high internal and external fit (Baird & Meshoulam, 1988; Lengnick-Hall & Lengnick-Hall, 1988). This review leads us to a discussion of issues in assessing fit. Next, we make some suggestions that we hope will aid in building a cumulative body of knowledge, something that is crucial for advancing theory and for making more meaningful and influential policy recommendations. Specifically, we focus on addressing the significance of findings, the relative emphases on theory and empirical research (and replication), and the measurement of effectiveness. We also describe some of the typical specification errors research in this area is susceptible to and some thoughts on how to avoid such errors. Finally, we summarize some of the key policy and research implications of the special forum and the broader body of work on human resources and organizational performance.

HR AS A UNIQUE SOURCE OF SUSTAINED COMPETITIVE ADVANTAGE

Recent theoretical work in business strategy has given a boost to the prominence of HR in generating sustained competitive advantage. According to the resource-based view of the firm (e.g., Barney, 1986, 1991, 1995), firms can develop sustained competitive advantage only by creating value in a way that is rare and difficult for competitors to imitate. Although traditional sources of competitive advantage such as natural resources, technology, economies of scale, and so forth, create value, the resource-based argument is that these sources are increasingly easy to imitate, especially in comparison to a complex social structure such as an employment system. If that is so, human resource strategies may be an especially important source of sustained competitive advantage (Lado & Wilson, 1994; Pfeffer, 1994; Wright & McMahan, 1992).

The concept of the HR system as a strategic asset has implications for both the characteristics and the effects of such a system. Strategic assets are "the set of difficult to trade and imitate, scarce, appropriable, and specialized *resources* and *capabilities* that bestow the firm's competitive advantage" (Amit & Shoemaker, 1993: 36). Unlike capital investments, economic scale, or patents, a properly developed HR system is an "invisible asset" (Itami, 1987) that creates value when it is so embedded in the operational systems of an organization that it enhances the firm's capabilities. This interpretation is also consistent with the emphasis on "core competencies" developed by Prahalad and Hamel (1990), who argued that conventional measures of economic rents such as the difference between the market and book value of assets (i.e., Tobin's q) reflect "core competence—people-embodied skills" (Hamel & Prahalad, 1994: 232).

Why might it be especially difficult to imitate human resource strategies that are deeply embedded in an organization? Two of the key factors are causal ambiguity and path dependency (Barney, 1991; Collis & Montgomery, 1995). First, it is difficult to grasp the precise mechanisms by which the interplay of human resource practices and policies generates value. To imitate a complex system, it is necessary to understand how the elements interact. Are the effects additive or multiplicative, or do they involve complex nonlinearities? As our later discussion of fit and synergy indicates, researchers are a long way from understanding the precise nature of these interactions. Without being able to understand how an HR system works, it is not possible to imitate it (by, for instance, "reverse engineering" it). It is even difficult for a competing firm to imitate a valuable HR system by hiring away one or a few top executives because the understanding of the system is an organizational capability that is spread across many (not just a few) people in the firm.

Second, these HR systems are path dependent. They consist of policies that are developed over time and cannot be simply purchased in the market by competitors. A competitor can understand that a system is valuable but is precluded from immediate imitation by the time required to fully implement the strategy (assuming the system could be understood). Further, there may be limits on management's ability to successfully replicate socially complex elements such as culture and interpersonal relationships.

As Table 1 indicates, the studies contained in this volume are consistent in their support of a link between HR and performance, suggesting that HR decisions do influence value creation. Whether these value-creating HR practices are sufficiently rare and inimitable to create sustained competitive advantage probably depends in part on the nature of their overall configuration and fit, a topic discussed below.

Is There One Best Way, Many Best Ways, or Does It Depend?

Much of the research on the link between HR and firm performance has looked at single HR practices such as compensation (e.g., Gerhart & Milkov-

TABLE 1
Studies Included in the Research Forum, by Key Characteristics

Study	Level of Analysis			Effectiveness Measure(s)	Support for HRM Effects?		Longitutinal Data?
	Firm	Business Unit	Facility		Main	Fit	
Davidson, Worrell, & Fox	Yes	No	No	Stock price	Yes	Not tested	Yes
Welbourne & Andrews	Yes	No	No	Stock price Survival	Yes	Not tested	Yes
Delery & Doty	Yes	No	No	Profitability	Yes	Weak	No
Delaney & Huselid	Yes	No	No	Survey	Yes	Weak	No
Youndt, Snell, Dean & Lepak	No	No	Yes	Survey	Yes	Mixed	No
Banker, Lee, Potter, & Srinivasan	No	No	Yes	Sales Customer satisfaction Profit	Yes	Yes	Yes
Banker, Field, Schroeder, & Sinha	No	No	Yes	Productivity Product quality	Yes	Not tested	Yes

ich, 1990) or selection (e.g., Terpstra & Rozell, 1993). The implicit assumption is that the effects of different HR decisions are additive, an idea that is inconsistent with the emphasis on internal fit in the resource-based view of the firm. With its implicit systems perspective, the resource-based view of the firm suggests the importance of "complementary resources," the notion that individual policies or practices "have limited ability to generate competitive advantage in isolation," but "in combination . . . they can enable a firm to realize its full competitive advantage" (Barney, 1995: 56). This idea, that a system of HR practices may be more (or less) than the sum of the parts, appears in discussions of synergy, external and internal fit, bundles, holistic approaches, configurations, contingency factors, and so forth (Amit & Shoemaker, 1993; Delery & Doty, this issue; Doty, Glick, & Huber, 1993; Dyer & Reeves, 1995; Gerhart, Trevor, & Graham, 1996; Huselid, 1995; Legnick-Hall & Legnick-Hall, 1988; Meyer, Tsui, & Hinings, 1993; Milgrom & Roberts, 1995). In contrast, others are more apt to suggest that there is an identifiable set of best practices for managing employees that have universal, additive, positive effects on organizational performance (e.g., Applebaum & Batt, 1994; Kochan & Osterman, 1994; Pfeffer, 1994; Schmidt, Hunter, & Pearlman, 1981). Youndt, Snell, Dean, and Lepak (this issue) maintain that the two approaches are in fact complementary.

Pfeffer (1994) argued that the empirical support for contingencies is sufficiently weak that a "best practice" perspective should be the preferred approach. However, even within the best practices approach, researchers have much to learn about what constitutes a high performance HR strategy. Studies of so-called high performance work systems vary significantly as to the practices included (see Table 2) and sometimes even as to whether a practice is likely to be positively or negatively related to high performance. For example, Arthur's (1994) high performance employment system, which he termed a "commitment" system, specifies a low emphasis on variable pay, whereas the high performance employment systems defined by Huselid (1995) and MacDuffie (1995) have strong emphases on variable pay. Another example would be HR strategies that rely on internal promotions and provide access to employee grievance procedures. Huselid (1995) and Pfeffer (1994) described such practices as high performance. Other studies (Arthur, 1994; Ichniowski et al., 1994) have included these practices as elements of more rigid HRM systems often associated with less productive unionized environments. Huselid and Becker (1995) termed these two practices "bureaucratic HR" and found them to have economically and statistically significant, negative effects on firm profitability in two different data sets.

The notion of best practices probably requires some clarification as well. The term is typically used in a way that connotes both the level of policy and the breadth of effect. At the level of policy, best practice brings to mind very specific forms of performance appraisal or team incentive systems that might be benchmarked. The implicit asumption of benchmarking is that the *effects* of a best practice are generalizable, and not firm specific. We believe

TABLE 2
High Performance Work Practices, by Authors

Practice	Kochan & Osterman	MacDuffie	Huselid	Cutcher-Gershenfeld	Arthur
Self-directed work teams	Yes	Yes		Yes	Yes
Job rotation	Yes	Yes			
Problem-solving groups/quality circles	Yes	Yes		Yes	Yes
TQM	Yes	Yes			
Suggestions received or implemented		Yes			
Hiring criteria, current job vs. learning		Yes			
Contingent pay		Yes	Yes		Yes
Status barriers		Yes			
Initial weeks training for production, supervisory, & engineering employees		Yes			
Hours per year after initial training		Yes	Yes		Yes
Information sharing (e.g., newsletter)			Yes		
Job analysis			Yes		
Hiring (nonentry) from within vs. outside			Yes		
Attitude surveys			Yes		
Grievance procedure			Yes		
Employment tests			Yes		
Formal performance appraisal			Yes		
Promotion rules (merit, seniority, combination)			Yes		
Selection ratio			Yes		
Feedback on production goals				Yes	
Conflict resolution (speed, steps, how formal)				Yes	Yes
Job design (narrow or broad)					Yes
Percentage of skilled workers in facility					Yes
Supervisor span of control					Yes
Social events					Yes
Average total labor cost					Yes
Benefits/total labor cost					Yes

there may be some confusion regarding the level of analysis (policies and practices) and the generalizability of these effects.

Although HR often focuses on the level of practice, the strategic emphasis implied by the subject of this special research forum would probably have to be a higher-level system characteristic if it were to have a generalizable best practice effect. In other words, if there is a best practice effect it is more likely to be in the "architecture" of a system. Although Pfeffer (1994) referred to them as management "practices," many of the characteristics he identified as part of a high performance work system would fit under this architectural rubric. For example, one architectural element of a high performance HR system might be that employee performance is valued and rewarded. It is this architectural characteristic that would be expected to have the generalizable (best practice) effect on firm performance. Table 3 illustrates the relationship between levels in an HR system and the generalizability of their effect, for one dimension of that system. There may be a best HR system architecture, but whatever the bundles or configurations of policies implemented in a particular firm, the individual practices must be aligned with one another and be consistent with the HR architecture if they are ultimately to have an effect on firm performance. In this sense the best practice and contingency hypotheses are not necessarily in conflict—they simply operate at different levels of an HR system. Case studies of Lincoln Electric and Hewlett-Packard reflect this interpretation (Milgrom & Roberts, 1995). Two companies with dramatically different HR practices arguably have quite similar HR architectures. For example, although the specific design and implementation of their pay and selection policies are different, the similarity is that both link pay to desired behaviors and performance outcomes and both effectively select and retain people who fit their cultures.

We believe that future research on the best practice–fit debate should carefully consider the level of analysis within an HR system. Terms like best practice may have one implication for managers and another for researchers.

TABLE 3
Implications of Best Practice for HR System Structure and Effects

Concept	Example	Effect
System architecture: Guiding principles	Employee performance is valued	Generalizable or universal
Policy alternatives: Mix of policies consistent with architecture and appropriately aligned internally and externally	Mix of performance appraisals, incentive pay, promotions	Contingent on appropriate firm-specific alignments
Practice process: Best-in-class implementation and technique *given* appropriate decisions at architectural level	State-of-the-art 360-degree performance appraisal Team-based incentive compensation	Contingent on particular policy alternatives

Cross-sectional relationships that are interpreted as a best practice effect must be consistent with the conceptual requirements of competitive advantage described above. Otherwise, this research can be misinterpreted by HR and line managers attempting to apply these results to their own organizations. Traditionally, HR managers have focused their efforts largely on the second and third levels of the HR system in Table 3, and within those levels there was little attention to either internal or external alignment. We are concerned that research emphasizing best practice results not be interpreted as suggesting that firms simply extend this traditional focus to HR policies and practices. In short, HR managers should not be misled into thinking that adding (or subtracting) points on the rating scales used in their performance appraisal systems will have a strategic impact on organizational performance.

Thus far, the evidence from research attempting to resolve the best practice–fit debate has been mixed at best (Gerhart et al., 1996) and, as Table 1 indicates, the articles included here tell a similar story. Why is this the case? Although conceptually the notion of fit has been considered more broadly (Venkatraman, 1989), in practice researchers have tended to be fairly simplistic, typically thinking in terms of statistical interactions between only two variables at a time (e.g., pay and business strategy) and specifying that the nonparallel response functions are linear. In a discussion of these issues as they apply to compensation research, Gerhart and colleagues (1996) suggested that although best practices are consistent with institutional theory and efforts to strive for parity, contingency models follow more directly from resource-based approaches and efforts to achieve sustained competitive advantage. They noted the following:

> In some senses, the high potential for resource-based approaches begins where the benefits of institutional approaches end. For instance, after best practices add value to the firm . . . firms may extract additional benefits by adding complexity to the program and integrating it with other firm functions (Gerhart et al., 1996: 153).

Huselid and Becker (1995) provided indirect support for this hypothesis. Using a measure of high performance work systems that increased in value with a firm's above-average ratings on each of 17 characteristics that broadly reflected skill development, performance management, and the strategic role of an HR system, these researchers reported considerable evidence of nonlinearity in the effects of these changes on firm market value. Figure 1 describes these results. HR system was measured in standard units to reflect the notion of relative importance implicit in competitive advantage. The X axis depicts those standard scores as equivalent percentiles. The Y axis expresses market value per employee, so the slope reflects the change in that value associated with a given percentile improvement in a firm's HR system.[2]

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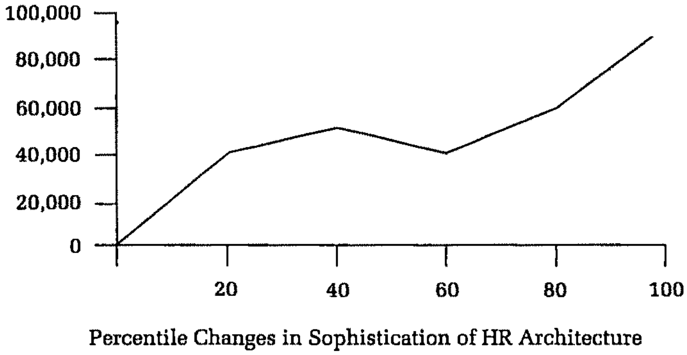
[2] As the origin of Figure 1 is arbitrarily set to zero, the reader should not interpret the market value for firms at the 60th percentile as $45,000 per employee. The sample average for these data is approximately $320,000 per employee.

FIGURE 1
Percent Change in Market Value per Employee



Source: Huselid and Becker (1995).

These findings suggest that firms enjoy considerable gains as they "get in the game." During this phase (0–20th percentile), the HR system is moving from being an impediment to firm performance to being a neutral influence. Firms in the broad middle ground (20th–60th percentile) may concentrate on professionally developed best practices, but these improvements are not what is required for sustained competitive advantage and improved firm performance. The last group, the firms above the 60th percentile, arguably have all the appropriate best practices, but more important, have begun to integrate those practices into a system that fits the firms' operational fabrics. The impact on firm performance is the same as in those HR systems below the 20th percentile, but for different reasons. Unfortunately, this evidence is entirely inferential. Research that directly measures this best practice–contingency continuum and its effects on market value should be an important priority for future work.

Configurational approaches also suggest that the typical approach to fit needs to be revisited (Arthur, 1995; Delery & Doty, this issue; Doty et al., 1993; Meyer et al., 1993). Indeed, when it is realized how simple notions and tests of contingency have been, the distinction between best practice and contingency models begins to blur. Consider, for example, that in the best practice model, the main effect coefficient in a regression equation reflects all contingencies in the sample. In essence the coefficient is the weighted average of those interaction terms not included in the model. A test of the contingency model typically enters the cross-product of an HR characteristic (e.g., degree of variable pay) and a contingency factor (e.g., corporate strategy). A statistically significant cross-product is taken as support for the contingency hypothesis. However, this statistical interaction is also universal (a best practice) because it implies that, all else being equal, the effect of a change in the HR characteristic on organizational performance is β_i for a given value of corporate strategy. In other words, for a particular corporate strategy, the HR system has a universal, or constant, effect on organizational performance.

In a sense, simply entering cross-products to test fit hypotheses may show just how little is known about systems of HR practices.[3] When one actually attempts to develop specific hypotheses about what staffing, compensation, and several other activities should look like in one or more synergistic effective systems, one quickly realizes that theories are not typically advanced enough to do much more than suggest that some dimensions of staffing, pay, development, and so forth should be "high" or "low."

A related issue concerns the statistical methods used when researchers attempt to derive configurations empirically. Approaches like factor analysis and principal components analysis, which are based on the general linear model, extract linear combinations of variables. Yet configurations may well contain variables that are not linearly related, suggesting that greater consideration should be given to the use of methods like cluster analysis (Arthur, 1992, 1994) or neural network analysis (Woelfel, 1993), which impose fewer restrictions of this sort.

Is There a Downside to Fit?

Lest researchers become too enamored with the advantage of tight fit or alignment of HR practices with internal and external contingency factors, we should note the potential downside of tight fit. Tightly coupled systems, because of their complexity and the high interdependence between system elements, may break down in unexpected ways, and they may not be very adaptable to change (Gerhart et al., 1996; Orton & Weick, 1990; Perrow, 1984).

One example, Schneider's attraction-selection-attraction model (Schneider, 1987; Schneider, Goldstein, & Smith, 1995), suggests that the people in organizations can become somewhat homogeneous over time because people tend to hire in their own image and this process is self-reinforcing. Although this homogeneity may work well under a given set of contingencies faced by an organization, any change in those contingencies may result in a homogeneous organization's having difficulty in adapting because of its lack of diversity in competencies. This formulation suggests that one of the elements of a high performance HR system, under changing circumstances, must be flexibility. Although flexibility is not a hallmark of most organizational systems, if strategic HR systems are genuinely aligned around business problems and operating initiatives, and that perspective is embedded in the system and the organization, all stakeholders will be anticipating system change as they see the business problems evolving.

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[3] There are also methodological problems with entering cross-products. It is well known that the statistical power of significance tests of cross-products is often low. Therefore, more attention needs to be devoted to using tools like LISREL to correct for measurement error carrying out such tests (Gerhart et al., 1996; Jaccard & Wan, 1995).

DEVELOPING A CUMULATIVE BODY OF KNOWLEDGE

In addition to sorting through these important conceptual issues, researchers should address several methodological challenges if empirical progress is to be made. The first of these goes to the fundamental focus of empirical research in this literature and what is required to build a cumulative body of knowledge. For example, Cohen (1994) and Schmidt (in press) have argued that empirical research in psychology should move away from its traditional reliance on statistical significance tests and focus more on point estimates of effect sizes and confidence intervals to build a more cumulative body of knowledge. We believe this same conclusion applies to management research generally, and to the question of the HR–firm performance relationship in particular. We would like to see all studies report raw regression coefficients, which reflect not only the direction, but also the *magnitude* of the effect of HR on organizational performance. The raw regression coefficient helps answer questions such as, What is the change in shareholder return due to a particular change in the HR system? The answer to this question is much more meaningful than the answer provided by a test of statistical significance that poses the question, Is the relationship different from zero?

Cohen (1994: 1001) saw this reticence to discuss results in terms of effect sizes as an implicit indictment of the measures being used. Following Tukey (1969), Cohen suggested that the reason researchers avoid using raw regression coefficients as indicators of effect sizes is because doing so would often confront them with the fact that their measures have no inherent meaning. This problem should be avoidable in HR–firm performance research because the dependent variables, organizational outcomes such as shareholder return, profits, productivity, and organizational survival, are typically directly observable and have meaningful natural metrics. The independent variables, HR activities and systems, can also often be measured in terms of natural metrics that are ratio scales (e.g., the percentage of employees in teams, annual hours of formal training), although rating scales that are at best interval scales (e.g., degree of employment security, focus on participation, value placed on human resources) continue to be used in many studies. All else being equal, ratio scales are to be preferred.

The reliance on statistical significance tests, and similar emphases on explained variance (i.e., hierarchical regression analysis), may also reflect a bias toward theory development, which may come at the heavy expense of not being able to develop a cumulative body of meaningful empirical results. Although theory development is critical to the development of a discipline, a proliferation of theories and concepts can impede the accumulation of knowledge (Pfeffer, 1993). Researchers should focus as much attention on generating a cumulative body of accurate and meaningful estimates of effect sizes as on generating new concepts and theories (Cohen, 1994; Pfeffer, 1994; Schmidt, in press). As our earlier discussion indicates, we believe good theoretical work is needed. However, it might be useful to focus more on synthesizing and organizing existing conceptual work into a more coherent theory with a greater number of specific, testable propositions to guide empirical work.

We are struck by the difference in emphasis between empirical research in management and that in a related field like labor economics. Both have well-developed theoretical traditions, but there is much more emphasis and respect in labor economics for careful and repeated efforts to improve empirical estimates of a theoretical relationship. A simple example, one analogous to the HR–firm performance question, would be the voluminous empirical literature that focuses on the effect of unionism or education on wages. Though in its best form it is rigorously informed by theory, this work rarely develops new theory. It is respected because when done well it provides a more accurate test of existing theory, and therefore improves cumulative knowledge on the subject. It is also respected because the subject itself is considered important, independent of the theory. The emphasis on unbiased estimates of effects, the inherent meaning of the measures, and the underlying importance of the subject go hand in hand. There is also much research in management that focuses on phenomena of more than theoretical interest. The HR–firm performance relationship is just one example. Theory development is always helpful, but we encourage an equal appreciation for empirical work that provides better and more meaningful tests of the theoretical frameworks already available.[4]

How Should Effectiveness and HR Be Measured?

The preceding discussion makes clear our preference for the use of effectiveness measures that have natural, meaningful metrics (e.g., shareholder return, profits, organizational survival, productivity, cycle time, customer complaints). The appropriate dependent variable will vary with the level of analysis, but in each case the focus should be on variables that have inherent meaning for a particular context. At the corporate level, capital market measures of performance are generally considered more comprehensive than contemporaneous accounting-based measures of profit (return on assets or equity). For example, a firm that has emphasized growth at the expense of current profits might have very different accounting measures than a high-profit company in a mature industry. However, market value measures that reflect the present value of future cash flows would reflect the profit potential of the high-growth company, and the performance of the two companies would be valued more similarly.

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[4] We do not wish to overstate the degree of consensus in the union-wage and education-wage literatures. These (and other literatures, such as those on the effects of minimum wage laws) contain considerable debate—reflecting competing theoretical explanations—regarding the actual point estimates, even though the estimated relationships are much more narrowly defined than is the norm in much management research. Our point, however, is that these debates focus on obtaining point estimates in meaningful units, and there is perhaps more of a sense of progress in cumulating results in these other empirical literatures.

Although studies that use the firm as the exclusive unit of analysis provide the most generalizable and direct test of the relationship between HR and firm financial performance (Huselid, 1995; Huselid & Becker, 1996), to date they have provided little insight into the process by which this value is created. Moreover, to the degree that researchers attempt to compare firms that differ with respect to industry, size, and so forth, they need to take pains to control for these and other factors that might be confounded with HR and related to market value. Researchers also need to give careful thought to the meaning of HR measures at the corporate level because HR practices often differ substantially across business units and facilities within a corporation, particularly as diversification and size increase.

Alternatively, multifacility studies within a single industry group (e.g., Arthur, 1994; Delery & Doty, this issue; Ichniowski et al., 1994; MacDuffie, 1995; Youndt et al., this issue) or company (Banker, Lee, Potter, & Srinivasan, this issue), and case studies of single firms or plants (Banker, Field, Schroeder, & Sinha, this issue) provide a clearer, if more narrow, picture of the mechanisms by which HR systems might create value. Capital market measures of performance are not available at the facility level, but there are generally other meaningful measures such as cycle time, customer satisfaction, productivity, scrap rates, and so forth that are conceptually linked with firm performance. Similarly, although capital market measures are not typically available at the business-unit level, measures such as growth, market share, and perhaps profits may be available.

In the absence of capital market measures, however, conducting research in a diverse sample of business units having different objectives may in some cases move a researcher away from a standard metric. Some units may be focused on profitability, but others are striving for market share or growth. If one set of HR practices is very helpful in contributing to profitability, but not very helpful in generating growth, while a second set of HR practices relates negatively to profitability, but positively to growth, an empirical study will probably find little relationship between HR and unit performance if each unit's effectiveness is defined in terms of profitability or growth alone.

Instead, it may be necessary to interject some subjectivity into the measurement of effectiveness to measure how effective a given unit has been in achieving its own key objectives (Campbell, 1977; Kahn, 1977; Mahoney & Weitzel, 1969; Tsui, 1990). Therefore, a unit with low profits and high growth would receive a high score on effectiveness if its key objective was growth. A unit with the same profits and growth could receive a low score if its key objective was profitability. One key to using such an approach would be to demonstrate high interrater agreement in assessments of effectiveness (and in the dimensions of effectiveness that are selected).[5]

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[5] We recognize that different constituencies may have very different notions of which organizational goals are most important and therefore, consensus among all constituencies on all goals is not realistic (Perrow, 1961). We also recognize that estimating the utility of attaining different goals in different organizations and making comparisons is subject to numerous pitfalls (Hannan & Freeman, 1977).

We noted previously that researchers do not necessarily focus on the same HR practices when studying HR systems and their links with organizational performance (see Table 2). These differences make it more difficult to cumulate findings. Even when the same HR practices are included in different studies, researchers may still use different measures, further hindering efforts to cumulate findings. For example, although the concept of contingent pay is included in studies by MacDuffie (1995), Huselid (1995), and Arthur (1992), its measurement differs in each case. Huselid used the proportion of the workforce covered by profit sharing, gainsharing, and merit pay, whereas Arthur asked what percentage of employment costs was accounted for by bonus or incentive payments. Although both approaches have merit, and meaningful substantive relationships should not be specific to particular ways of measuring a construct, it may be time for researchers to focus more on standardization and replication in measuring HR. (One means is to have different researchers jointly design measures. See Latham, Erez, and Locke [1988] for an example.)

Obtaining More Robust and Valid Findings

Future work on the strategic perspective must elaborate on the black box between a firm's HR system and the firm's bottom line. Unless and until researchers are able to elaborate and test more complete structural models—for example, models including key intervening variables—it will be difficult to rule out alternative causal models that explain observed associations between HR systems and firm performance. Our call for papers for this special issue laid out a range of effectiveness measures for this very reason, although, as Table 1 indicates, no one study looked at both firm-level performance outcomes and either facility or business-unit performance outcomes. The best we can do is look at the group of studies and say that HR was linked to performance at both the firm and facility level. The fact that none of the studies used business-unit-level outcomes may indicate the difficulty of measuring performance at this level. There is clearly a need to fill in this gap at the business-unit level and to pay attention not only to traditional financial outcomes, but also to intermediate and process-related criteria that indicate how financial results are achieved (see, for example, Kaplan and Norton's [1992] "balanced scorecard" approach).

Without intervening variables, one is hard pressed both to explain how HR influences firm performance and to rule out an alternative explanation for an observed HR–firm performance link such as reverse causation. To take a simple example (indeed, one that ignores internal and external fit considerations), the fact that profit sharing is associated with higher profits can be interpreted in at least two ways: profit sharing causes higher profits, or firms with higher profits are more likely to implement profit sharing. However, if it can be demonstrated that employees in firms with profit sharing have different attitudes and behaviors than those in firms without profit sharing and that these differences also translate into different levels of customer satisfaction, productivity, speed to market, and so forth, then researchers can begin to have more confidence in the causal model. Obviously, collecting such data will be a major undertaking because they will need to come from multiple sources. Again, none of the studies included here were able to do this.

Past work has emphasized alignment with corporate or business strategy, although recent reviews suggest that there is not a great deal of empirical support for the existence of such contingencies (Gerhart et al., 1996; Pfeffer, 1994; but see Gomez-Mejia and Balkin [1992] for more supportive findings). In view of Table 1, tests for such contingencies may hold more promise as the focus moves away from a broad corporate strategy to either an industry-specific (Youndt et al., this issue) or firm-specific context.

It may very well be that the source of the HR effect on firm performance and its inimitability is an "idiosyncratic contingency" (Huselid & Becker, 1995). Namely, HR systems only have a systematic impact on the bottom line when they are imbedded in a firm's management infrastructure and help it solve real business problems such as product development cycle times, customer service, and so forth. The particular form of these problems, and more important, the appropriate alignment of the HR system, are much more firm-specific than corporate strategies of cost leadership or differentiation.[6] A properly aligned HR system would represent a core capability (Stalk, Evans, & Shulman, 1992) and become a form of organizational capital (Tomer, 1988). Cappelli and Crocker-Hefter (1996) provided several intra-industry case studies and reported that their comparisons revealed no best practice; rather, each firm had a distinctive HR system that represented a core competency for that particular organization. This argument also implies that the multifirm-multiindustry studies required to capture variation in corporate strategies are not well suited to revealing the presence of these idiosyncratic contingencies.

To the extent that the appropriate alignment of an HR system with a particular firm's business problems is idiosyncratic and complex (i.e., multivariate and nonlinear), there would be no best practice in the sense that the term has been used in this literature. Indeed, this would suggest a very strong contingency that largely turns on the ability of a firm to align its HR system with its unique business problems or operating initiatives. This interpretation suggests the need for deeper qualitative work on the array of contingency factors and the potentially complex and nonlinear interactions among them that determine alignment. It may also imply a different research focus. Prior work tends to measure HR policies and to draw inferences about alignments and contingencies based on the effects of those policies combined with other policies or strategies (interaction terms). However, if alignments and contingencies are theoretically important, empirical work should measure these theoretical constructs directly. These alignments would be very difficult to measure across firms and industries, but to the extent these contingencies are indeed idiosyncratic, finding a "universal" contingency cross-sectionally would depend on using a measure of this type.

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[6] This discussion is similar to the debate over situational specificity of empirical relationships (e.g., selection predictor validities) in the meta-analysis and validity generalization literatures. Recent work questions the underlying statistical assumptions of the Hunter-Schmidt meta-analysis model and suggests that situational specificity may be found more often using different models (Erez, Bloom, & Wells, 1996).

Specification and Measurement Errors

Our emphasis on building a cumulative literature of accurate point estimates of the HR–firm performance highlights the importance of two methodological issues in this research. Specification errors occur when estimation models omit variables that covary with the HR system and also influence firm performance. Depending on the performance measure, these may include industry, size, business strategy, capital structure, and the quality of management in areas other than HR (e.g., finance and marketing). Although the concern typically focuses on estimates that are *positively* biased, it is equally plausible that prior estimates have underestimated the true relationship. These sources of heterogeneity bias are typically addressed through use of a more comprehensive set of control variables. However, if in principle these omitted variables are measurable, they are not always accessible. If these omitted variables vary across firms, but are relatively fixed over time, longitudinal data can be used to produce "fixed effects" estimates that may be more accurate.

An alternative means of controlling for specification error is to select a sample that is homogeneous with respect to potential omitted variables. Although this approach has some costs in terms of external validity, it can be a useful way to avoid comparing apples and oranges. Table 1 indicates that both approaches were used in the present set of studies.

Random measurement error (unreliability) in HR systems measures will also tend to bias regression coefficients. Future research would benefit from the use of multiple raters from each organization, business unit, or facility studied, particularly where subjectivity or judgment is required. To the extent that prior work has been based on measures with less-than-desirable reliability characteristics, estimates of the HR–firm performance relationship are probably understated. Huselid and Becker (1996) illustrated this point. They used a two-period panel to estimate the effects of both heterogeneity bias and random measurement error in HR systems measures and found the two forms of bias largely offset each other. First difference (fixed effects) estimates of the HR–performance relationship were similar to cross-sectional estimates when the former were adjusted for random measurement error.

Another form of specification error, commonly referred to as method bias, can occur if one respondent from each firm provides information on both HR and performance, and firm performance is measured subjectively. The respondent may be systematically biased upward or downward in reporting both (especially as questions become more evaluative or as HR practices come to be viewed as best practices). One way to reduce such problems is

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to collect HR and performance information from different respondents (cf. Youndt et al., this issue). Even when firm performance is based on objective financial data, a simultaneity bias may arise if a respondent makes an inference about the nature or value of HR practices in response to the level of firm performance.

Diffusion

At times, there appears to be a major "disconnect" between what the research literature says that firms should do and what firms actually do. If, for example, variable pay, extensive training (in multiple areas), and employee involvement in decisions are associated with positive outcomes, why doesn't everyone engage in such "best practices"? One generic explanation is that there needs to be better communication between the academic and managerial communities so that research findings can have a greater influence on actual policy. This point is undoubtedly part of the explanation. In addition, institutional theories suggest that efficiency is only one explanation for why practices do or do not diffuse.

Another part of the story may be that managers often know something that researchers do not know. A simple implication for researchers, then, is that more effort should be devoted to finding out what managers are thinking and why they make the decisions they do. This suggests a need for deeper qualitative research to complement the large-scale, multiple-firm studies that are available.

It also suggests the need for more attention to studies that have program adoption and survival as dependent variables (Gerhart et al., 1996; Johns, 1993; Kochan & Osterman, 1994; Pfeffer, 1994). It may be that certain HR programs have the potential for high payoffs, but are also risky in the sense that they are prone to failure. It may be that use of convenience samples leads to an overrepresentation of the successes and an underrepresentation of the failures, and thus the risks and expected value, of implementing certain programs. Perhaps managers have better estimates of real risk and factor these into their decisions, which would help explain divergence between research and practice. Again, however, researchers will not know the answer without devoting more effort to studying the factors that influence managers' decisions to adopt and terminate practices.

POLICY IMPLICATIONS

With the exception of executive compensation issues, subjects of direct import for CEOs and other senior line managers have typically not been a focus of HR research. As Table 1 indicates, this situation has changed. The studies included here provide support for the strategic impact of HR on key performance outcomes, and we hope this special issue will hasten the development of a cumulative body of knowledge that offers a new strategic lever for senior management.

What are the policy implications of this work? The most fundamental implication is that the choice of HR systems can have an economically significant effect on firm performance. Research is just beginning to establish the plausible range of these effects, but early work indicates that reasonable changes in an HR system can affect a firm's market value by \$15,000–\$45,000 per employee (Davidson et al., this issue; Huselid & Becker, 1995, 1996) and can affect the probability of survival for a new firm by as much as 22 percent (Welbourne & Andrews, this issue). Other research has established strong HR effects on intermediate outcomes (see Table 1) that are consistent with an ultimate bottom line effect. In sum, at multiple levels of analysis there is consistent empirical support for the hypothesis that HR can make a meaningful difference to a firm's bottom line.

Thus, extant research suggests that HR systems have considerable economic potential, but there is little consensus on how to achieve that potential. There appears to be no best practice magic bullet short of organizing a firm's HR system from a strategic perspective. Therefore, both HR system and HR function must have as their principal focus a set of properly aligned HR policies that solve business problems and support the firm's operating and strategic initiatives. Although the empirical research has been less than compelling thus far, the theoretical and practitioner literatures suggest that simply instituting best-in-class HR programs and practices from a functional perspective will not have the type of strategic impact that a properly configured HR system will. A set of practices that have individual, positive effects on performance may be a necessary, but not sufficient, condition for a larger effect on firm performance.

This perspective implies that firms should very carefully evaluate their decisions to outsource HR responsibilities. We have argued that some aspects of the HR function are appropriately judged as cost centers (e.g., benefits administration) but that other elements of an HR system create value as part of a firm's strategic infrastructure. Although a decision with respect to outsourcing might be straightforward at the two ends of the cost-value creation continuum, for many elements of an HR system the decision is not so clear. In some respects, as a firm moves toward a strategic perspective on the HR system, HR activities like recruiting and hiring, which might be considered best outsourced when measured against a cost standard, might well be retained if their alignment with the remainder of the HR system is a critical source of value for the entire system. This situation would be more likely when it is the entire HR system that is the source of value, and the core competencies required to create this value are largely firm-specific and not easily replicated through outsourcing.

With the emergence of a strategic role for human resources, the HR function and indeed the traditional discipline of human resources are at a crossroads. If HR functional managers ignore this opportunity, the HR function will be left with traditional transaction and compliance activities, forced to justify itself on a cost basis, and in many cases will be outsourced (Brenner, 1996; Corporate Leadership Council, 1995; Csoka, 1995; Stewart, 1996). The research that is the focus of this special issue points to the importance of the HR system, not necessarily to the importance of the HR function. If HR functional managers do not take advantage of this opportunity, firms will no doubt find others in the organization who will.

The leadership of this strategic HR role in organizations will also be reflected in the competition for the intellectual leadership of this emerging area. The recent spate of special issues on the subject reveals not only its prominence, but also the disciplinary range of intellectual interest in the topic. We are concerned that if the traditional HR discipline does not embrace the wider interdisciplinary approach required to produce a meaningful contribution to this area, other disciplines will, and HR as a discipline runs the same risk as the HR function of being marginalized.

In his 1993 Presidential Address to the Academy of Management, Donald Hambrick asked the question, What if the Academy actually mattered? (Hambrick, 1994). He argued that "the major debates regarding business and management are framed almost entirely by lawyers and economists" (1994: 15), and he suggested that the reason management scholars did not have more influence was because of "our own failure to present ourselves—our body of knowledge and our perspective" (1994: 15) and that we needed to focus more on conducting research and drawing policy implications that "make a significant contribution to the solution of major problems facing our society and its value-creating enterprises" (1994: 15). We hope this Special Research Forum on Human Resource Management and Organizational Performance helps us move in that direction.

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MODES OF THEORIZING IN STRATEGIC HUMAN RESOURCE MANAGEMENT: TESTS OF UNIVERSALISTIC, CONTINGENCY, AND CONFIGURATIONAL PERFORMANCE PREDICTIONS

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The field of strategic human resource management (SHRM) has been criticized for lacking a solid theoretical foundation. This article documents that, contrary to this criticism, the SHRM literature draws on three dominant modes of theorizing: universalistic, contingency, and configurational perspectives. Seven key strategic human resource practices are identified and used to develop theoretical arguments consistent with each perspective. The results demonstrate that each perspective can be used to structure theoretical arguments that explain significant levels of variation in financial performance.

During the last decade there has been a dramatic shift in the field of human resource (HR) management. This shift has broadened the focus of HR research from the micro analytic research that dominated the field in the past to a more macro or strategic perspective. The strategic perspective of HR, which has been labeled strategic human resource management (SHRM), has grown out of researchers' desire to demonstrate the importance of human resource practices for organizational performance.

The basic premise underlying SHRM is that organizations adopting a particular strategy require HR practices that are different from those required by organizations adopting alternative strategies (Dyer 1984a, 1984b; Fombrum, Tichy, & Devanna 1984; Jackson & Schuler, 1995; Jackson, Schuler, & Rivero, 1989; Schuler & Jackson, 1987a, 1987b, 1988; Schuler & MacMillan,

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1984). If this fundamental assumption is correct, then much of the variation in HR practices across organizations should be explained by the organizations' strategies, and organizations that have greater congruence between their HR practices and their strategies should enjoy superior performance. There is some support for this assumption. For example, Schuler and Jackson (1988) and Arthur (1992) demonstrated that organizations following different strategies utilize different HR practices. Other researchers have demonstrated that HR practices can influence organizationally relevant outcomes such as productivity and profitability (Arthur, 1994; Gerhart & Milkovich, 1990; Huselid, 1993, 1995; Terpstra & Rozell, 1993).

Despite the growing body of empirical SHRM research, the field has been criticized for lacking a solid theoretical foundation (Bacharach, 1989; Dyer, 1985). This criticism arises, in part, because three different modes of theorizing have been employed in the field, but the differences among the alternative perspectives have not been explicitly acknowledged. Some authors have adopted a universalistic perspective (cf. Dewar & Werbel, 1979) and argued for a "best practices" approach to SHRM (Delaney, Lewin, & Ichniowski, 1989; Huselid, 1993, 1995; Osterman, 1994; Pfeffer, 1994; Terpstra & Rozell, 1993). These researchers, like many micro-level HR researchers, posit that some HR practices are always better than others and that all organizations should adopt these best practices. For instance, Pfeffer argued that greater use of 16 management practices, such as participation and empowerment, incentive pay, employment security, promotion from within, and training and skill development, results in higher productivity and profit across organizations. Similarly, Osterman (1994) argued that a number of innovative work practices, such as teams, job rotation, quality circles, and total quality management, result in productivity gains for all American organizations. In general, the practices identified by Pfeffer and Osterman have been labeled "high performance work practices," or simply "best practices."

A second group of researchers has adopted a contingency perspective (Butler, Ferris, & Napier, 1991; Dyer, 1985; Fombrum et al., 1984; Golden & Ramanujam, 1985; Gomez-Mejia & Balkin, 1992; Lengnick-Hall & Lengnick-Hall, 1988; Milkovich, 1988; Schuler & Jackson, 1987a). Contingency theorists argue that, in order to be effective, an organization's HR policies must be consistent with other aspects of the organization. For example, contingency theorists have attempted to show how a number of HR practices are consistent with different strategic positions and how these practices relate to firm performance (Balkin & Gomez-Mejia, 1987; Begin, 1993; Gomez-Mejia & Balkin, 1992; Schuler & Jackson, 1987a).

A third group of SHRM theorists has developed arguments that are consistent with the configurational approach that is emerging in the organization theory and strategic management literatures. Configurational theories differ from universalistic and traditional contingency theories because configurational theories are guided by the holistic principle of inquiry, are usually based on typologies of ideal types, and explicitly adopt the systems assumption of "equifinality" (Doty, Glick, & Huber, 1993; Doty & Glick, 1994; Meyer, Tsui, & Hinings, 1993; Miller & Friesen, 1984; Venkatraman & Prescott, 1990). In general, configurational theories are concerned with how the *pattern* of multiple independent variables is related to a dependent variable rather than with how individual independent variables are related to the dependent variable. Wright and McMahan appeared to suggest that the configurational perspective was an appropriate approach for SHRM when they argued that SHRM is concerned with "the *pattern* of planned human resource deployments and activities intended to enable an organization to achieve its goals" (1992: 298, emphasis added) and that, in order to be effective, an organization must develop an HR system that achieves both horizontal and vertical fit. Horizontal fit refers to the internal consistency of the organization's HR policies or practices, and vertical fit refers to the congruence of the HR system with other organizational characteristics, such as firm strategy. An ideal configuration would be one with the highest degree of horizontal fit.

Configurational notions are currently incorporated in both theoretical and empirical SHRM studies. Numerous authors have attempted to develop a priori typologies of effective HR systems and link the performance of HR systems to firm strategy. For example, Miles and Snow (1984) and Arthur (1992) developed multiple equally effective combinations of HR practices and argued that the different sets of practices are suited for different firm strategies. Configurational ideas are incorporated in empirical SHRM studies when researchers attempt to identify configurations of HR practices that predict superior performance when used in association with each other, or the correct strategy, or both. For example, Arthur (1992) argued that there are two prototypical employment systems, or groups of HR practices. Although he did not specifically state the idea, Arthur (1992) appeared to argue that the closer an organization's HR practices resemble the correct prototypical system (for its business strategy), the greater the performance gains. Similarly, MacDuffie (1995) derived specific configurations, or "bundles," of HR practices that enhance firm performance. Finally, Ichniowski, Shaw, and Prennushi attempted to test the hypothesis that "combinations of HRM practices have bigger effects on productivity than the sum of the component effects due to individual practices" (1994: 9, emphasis deleted). This is clearly an argument in support of a configurational perspective.

This article advances the SHRM literature by clearly articulating the important differences among the universalistic, contingency, and configurational perspectives that are used in the literature and then empirically testing hypotheses that are consistent with the logic of each of the three perspectives. Seven important HR practices that are common to much of the theoretical work in SHRM are identified. The individual practices are used to formulate a series of universalistic and contingency arguments that are parallel to different arguments found in the SHRM literature. Configurational arguments are then formulated by organizing the individual HR practices into two ideal-type employment systems that are posited to enhance firm performance. The employment systems form the basis of a series of configurational predictions.

The article demonstrates that each theoretical perspective is valuable and that explicitly acknowledging the theoretical frameworks will aid in developing SHRM theories.

THEORETICAL PERSPECTIVES OF STRATEGIC HUMAN RESOURCE MANAGEMENT

To date, SHRM has predominately been an applied field. The field's dominant focus has been to demonstrate the importance of effectively managing the human resources of organizations. Thus, a growing number of articles are appearing in the publications aimed at the practitioner community. Although this applied focus has helped to highlight the contributions of SHRM to organizations, it has not fostered sound theoretical development. What has emerged is a growing literature discussing the benefits of SHRM without sufficient articulation of the specific theoretical underpinnings of the field. Presented below are more complete articulations of the three major modes of theorizing imbedded in the field: the universalistic, contingency, and configurational perspectives.

Universalistic Perspective

Universalistic arguments are the simplest form of theoretical statement in the SHRM literature because they imply that the relationship between a given independent variable and a dependent variable is universal across the population of organizations. Developing universalistic predictions requires two steps. First, important strategic HR practices must be identified. Second, arguments that relate the individual practices to organizational performance must be presented.

Strategic HR practices. Strategic HR practices are those that are theoretically or empirically related to overall organization performance. Although not all HR practices are strategic, there is growing consensus about which practices can be considered strategic. Drawing on the theoretical works of Osterman (1987), Sonnenfeld and Peiperl (1988), Kerr and Slocum (1987), and Miles and Snow (1984), we identified seven practices that are consistently considered strategic HR practices. These are: internal career opportunities, formal training systems, appraisal measures, profit sharing, employment security, voice mechanisms, and job definition. Nearly all of these are also among Pfeffer's (1994) 16 most effective practices for managing people.

The first practice, internal career opportunities, refers to the use of internal labor markets. In other words, organizations can choose to hire predominantly from within or from outside. The second practice, training systems, refers to the amount of formal training given to employees. Organizations can provide extensive formal training or rely on acquiring skills through selection and some socialization. Third, appraisals can be based on results or behavior. Behavior-based appraisals focus on the behaviors of individuals necessary to perform the job effectively, whereas results-oriented appraisals focus merely on the consequences of those behaviors. Fourth, profit-sharing plans, which tie pay to organizational performance, have been seen as an integral part of a strategic HR system. Fifth, the degree to which employees are given employment security has many strategic implications. Although it is apparent in today's economy that even the most senior employees are not free from layoffs, there are particular groups of employees in organizations who undoubtedly have a greater sense of security in their jobs than other employees, either because of a formal or an informal policy of employment security. Sixth, voice mechanisms, both formal grievance systems and participation in decision making, have emerged as key factors. Finally, the degree to which jobs are tightly or narrowly defined is important. Tightly defined jobs are those in which the employees know the content of their jobs exactly. The job is limited in scope, and incumbents do not perform duties that are not considered part of the job. The job duties are more likely shaped by a well-defined job description than by individual action.

We view these seven practices as critical characteristics of employment systems in organizations and will use these practices individually and in combinations as the basis for hypotheses that are consistent with the alternative theoretical perspectives investigated here. There are other HR practices that might affect organizational performance. For example, Schuler and Jackson (1987a) presented a very comprehensive list of HR practices. However, the seven practices listed above appeared to have the greatest support across a diverse literature. Thus, in the interest of parsimony, we restricted our arguments and analyses to these seven practices.

Universalistic predictions. Theorists adopting a universalistic perspective posit that greater use of specific employment practices will always result in better (or worse) organizational performance. Many universalistic arguments seem reasonable. For example, conducting more valid performance appraisals or using more valid selection devices should always be better than using less valid measures.

Many researchers have supported universalistic predictions. Leonard (1990) found that organizations having long-term incentive plans for their executives had larger increases in return on equity over a four-year period than did other organizations. Abowd (1990) found that the degree to which managerial compensation was based on an organization's financial performance was significantly related to future financial performance. Gerhart and Milkovich (1990) found that pay mix was related to financial performance. Organizations with pay plans that included a greater amount of performance-contingent pay achieved superior financial performance. In combination, these studies indicate that organizations with stronger pay-for-performance norms achieved better long-term financial performance than did organizations with weaker pay-for-performance norms. Terpstra and Rozell (1993) posited five "best" staffing practices and found that the use of these practices had a moderate, positive relationship with organizational performance. Finally, Huselid (1993, 1995) identified a link between organization-level outcomes and groups of high performance work practices. Instead of focusing on a single practice (e.g., staffing), Huselid assessed the simultaneous use of multiple sophisticated HR practices and concluded that the HR sophistication of an organization was significantly related to turnover, organizational productivity, and financial performance. Overall, the level of support generated for universalistic predictions indicates that the universalistic perspective is a valid theoretical perspective for SHRM theorists.

The current study draws on research on HR system sophistication and high performance work practices to predict positive relationships between each of the seven strategic HR practices and organizational performance. Thus, we hypothesize

> *Hypothesis 1: There will be a positive relationship between financial performance and (a) the use of internal career ladders, (b) formal training systems, (c) results-oriented appraisal, (d) performance-based compensation, (e) employment security, (f) employee voice, and (g) broadly defined jobs.*

Contingency Perspective

Contingency arguments are more complex than universalistic arguments because contingency arguments imply interactions rather than the simple linear relationships incorporated in universalistic theories (Schoonhoven, 1981; Van de Ven & Drazin, 1985; Venkatraman, 1989). In other words, contingency theories posit that the relationship between the relevant independent variable and the dependent variable will be different for different levels of the critical contingency variable. The organization's strategy is considered to be the primary contingency factor in the SHRM literature. Thus, a contingency perspective requires a researcher to select a theory of firm strategy and then specify how the individual HR practices will interact with firm strategy to result in organizational performance.

A strategic contingency. We selected Miles and Snow's (1978) theory of strategy, structure, and process for the current study because this theory has several advantages. First, it has been shown to be a relatively powerful predictor of organizational effectiveness (Doty et al., 1993). Second, Miles and Snow (1984) explicitly stated that the theory had implications for an organization's HR policies. Third, the theory has commonly been used in the SHRM literature. Finally, existing studies present alternative interpretations of Miles and Snow's theory that allow it to be interpreted both as a contingency theory (Golden, 1992; Hambrick, 1983; Zajac & Shortell, 1989) and as a configurational theory (Doty et al., 1993; Segev, 1989). Thus, Miles and Snow's theory can be used with both the contingency perspective and the configurational perspective presented in this article.

Interpreting Miles and Snow's (1978) theory as a contingency theory requires a researcher to identify a single variable that differentiates the alternative strategies specified in the original theory. Most previous work has used rate of product, service, or market innovation as the central contingency variable (e.g., Hambrick, 1983; Zajac & Shortell, 1989). Firms that are highly innovative are considered prospectors, firms that are moderately innovative are considered analyzers, and firms that rarely innovate are considered defenders. Thus, the strategic positioning of all firms can be characterized by a single contingency variable: innovation.

Contingency predictions. In contingency predictions, the relationship between the use of specific employment practices and organizational performance is posited to be contingent on an organization's strategy. The behavioral perspective (Jackson et al., 1989) implies that successful implementation of business strategy relies heavily on employee behavior. An organization's strategy necessitates behavioral requirements for success, and the use of HR practices in the organization can reward and control employee behavior. Therefore, the organization should implement HR practices that encourage the employee behaviors that are consistent with the organization's strategy. This alignment of strategy and HR practices allows organizations to achieve superior performance.

Agency theory (Eisenhardt, 1988; Fama, 1980; Fama & Jensen, 1983) leads to similar predictions. If an employer knows what employee behaviors it needs, then the organization will enact policies and procedures that elicit these behaviors. In agency theory terms, the organization would simply be aligning the interests of the employer (principal) and the employee (agent). Organizations that do a better job of aligning these interests will achieve greater performance.

There are many ways that HR practices can be used to elicit from employees behaviors that are consistent with an organization's strategy. Since behavior is a function of ability and motivation, an organization can set up HR practices that ensure that individuals with the required abilities are hired and retained and can also use HR practices to ensure that employees are motivated to behave in ways consistent with the business strategy. Kerr and Jackofsky (1989) used the organizational growth strategies described by Leontiades (1980) to illustrate that, given a specific strategy, it is more useful to rely on employee selection than on employee development. They argued that "effectiveness will be greater for steady-state firms utilizing development to align managers with strategies" (1989: 165). Thus,

> *Hypothesis 2: The relationship between human resource practices and financial performance will be contingent on an organization's strategy.*

Configurational Perspective

Configurational arguments are more complex than those of either of the previous two theoretical perspectives for several reasons. First, configurational theories draw on the holistic principle of inquiry (Doty et al., 1993; McKelvey, 1982; Meyer et al., 1993; Miller & Friesen, 1984; Venkatraman & Prescott, 1990) to identify configurations, or unique *patterns* of factors, that are posited to be maximally effective. These configurations represent nonlinear synergistic effects and higher-order interactions that cannot be represented with traditional bivariate contingency theories (Doty & Glick, 1994). Second, configurational theories incorporate the assumption of *equifinality* by positing that multiple unique configurations of the relevant factors can result in maximal performance (Doty & Glick, 1994; Meyer et al., 1993). Third, these configurations are assumed to be ideal types that are theoretical constructs rather than empirically observable phenomena (Blalock, 1969; Doty & Glick, 1994; Meyer et al., 1993; McKinney, 1966; Weber, 1904). As a consequence of these differences, configurational theorists working in SHRM must theoretically derive internally consistent configurations of HR practices, or employment systems, that maximize horizontal fit, and then link these employment systems to alternative strategic configurations to maximize vertical fit.

Employment systems. A handful of SHRM researchers have developed theoretically derived employment systems (e.g., Kerr & Slocum, 1987; Osterman, 1987; Sonnenfeld & Peiperl, 1988). Drawing on the works of these previous theorists, we propose the following two employment systems: the market-type system and the internal system. These two systems, each of which can be described in terms of the seven employment practices discussed earlier, are summarized in Table 1.

TABLE 1
Characteristics of Employment Systems

HR Practices	Market-Type System	Internal System
Internal career opportunities	Hiring almost exclusively from outside the organization Very little use of internal career ladders	Hiring mainly from within the organization Extensive use of well-defined career ladders
Training	No formal training provided Little if any socialization taking place within the organization	Extensive formal training provided Great amount of socialization within the organization
Results-oriented appraisals	Performance measured by quantifiable output or results-oriented measures Feedback in the form of numbers and evaluative	Performance measured by behavior-oriented measures Feedback more for developmental purposes
Profit sharing	Profit sharing used extensively	Few incentive systems used Very little use of profit sharing
Employment security	Very little employment security given	Great deal of employment security among those who make it through the initial trial period Extensive benefits to those "outplaced" Formal dismissal policies
Participation	Employees given little voice in the organization	Employees likely have access to grievance systems Employees more likely to participate in decision making
Job descriptions	Jobs are not clearly defined Job definitions are loose	Jobs very tightly defined

The market-type system is characterized by hiring from outside an organization, providing little training, and evaluating performance through the use of results measures. Employees who work under this system are compensated or rewarded for individual performance as measured by the output measures. They are given little employment security and voice, and their jobs are usually broadly defined. This system is similar to the performance-based system outlined by Kerr and Slocum (1987), the baseball teams of Sonnenfeld and Peiperl (1988), and the type B system of Miles and Snow (1984).

The internal system is characterized by the existence of an internal labor market. Extensive socialization and training are common. Performance is assessed through behavior, and appraisal feedback is given for developmental purposes rather than evaluative purposes. A rather high degree of employment security is given. Employees are viewed as valuable sources of information and are provided a great deal of voice. Individuals in these jobs often have tightly defined job descriptions. This employment system is similar to the hierarchy-based system of Kerr and Slocum (1987), the clubs of Sonnenfeld and Peiperl (1988), and the type A system of Miles and Snow (1984).[1]

Strategic configurations. Miles and Snow's (1978) strategic typology can be interpreted as a configurational theory that identifies three ideal strategic types: the prospector, the analyzer, and the defender (Doty et al., 1993). The defender has a narrow and stable product-market domain and seldom makes major adjustments in its technology or structure. The emphasis is on better and more efficient ways to produce a given product or service and on defending a market. A defender does little research and development. When defenders pursue new products, they import the technology from outside the organization. Prospectors are characterized by their constant search for new products and markets. They continually experiment with new product lines and venture into new markets. These organizations are the creators of change in their markets and are the forces to which competitors must respond. As such, prospectors are more concerned with searching for new opportunities and will likely not be as efficient as defenders. Analyzers have characteristics of both defenders and prospectors. They usually operate in both stable product domains, like defenders, and new changing product domains—like prospectors. They are usually not the initiators of change, as are prospectors, but they follow the changes much more rapidly than do defenders.

Alignment of employment systems and strategic configurations. The strategic differences among the prospector, analyzer, and defender suggest that organizations pursuing these alternative strategies should implement different employment systems. Because defenders concentrate on efficiency in current products and markets, effective employment practices should emphasize a long-term commitment to an organization. The organization should value employees with greater firm- and product-specific skills and knowledge. The special skills and knowledge will be enhanced through formal training, well-established career paths within the organization, and performance appraisal and feedback systems that foster employee development rather than short-term results. These practices should create an environment that fosters long-term commitment to the organization and reduces the costs associated with replacement of workers and the knowledge, skills, and abilities they possess. To further limit "voluntary dysfunctional turnover" (Dalton & Todor, 1982), employees should be given a high amount of employment security and voice.

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[1] It should be noted that the internal system described here is similar to other systems labeled broadly as internal labor markets. However, as a reviewer noted, this internal system is different from the adversarial system that was found in many industrial settings, in that employees are highly valued and are given the opportunity to participate in decisions. For a more thorough discussion of the many forms of internal labor markets, see Pinfield and Berner (1994).

Prospectors, on the other hand, are constantly changing. They emphasize exploration into products and markets in which they traditionally have had little or no experience. Therefore, they are less aware of the specific behaviors that are necessary to perform well in these areas. Consequently, they will not be able to look inside their current organizations for the necessary skills and will have to hire from the outside to acquire the talent that will keep performance high. Because of the constant change in such an organization, there will be little emphasis on long-term commitment to it. The organization is constantly trying out new products and markets and will likely move on quickly if it appears that there is little opportunity for profit in an area. Thus, the organization will create a results-oriented appraisal system that measures performance on bottom-line measures.

In sum, the HR practices consistent with the internal system are appropriate for the defender strategy and include the use of (1) internal career opportunities, (2) formal training systems, (3) behavior-based appraisal, (4) hierarchy-based compensation (i.e., little profit sharing), (5) employment security, (6) employee voice, and (7) tightly defined jobs. Conversely, the prospector strategy requires the market system, which entails (1) few internal career opportunities, (2) lack of formal training systems, (3) output-based appraisal, (4) profit-sharing systems, (5) little employment security, (6) little employee voice, and (7) broadly defined jobs.[2]

Configurational predictions. The configurational predictions are based on the assumption that implementing the employment systems discussed above will result in higher organizational performance. However, there are at least three different configurational arguments relating the employment systems to organizational performance.

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[2] The most parsimonious interpretation of Miles and Snow's (1978) theory implies that the analyzer is at the midpoint between the prospector and defender (Doty et al., 1993). Thus, in the configurational analysis reported later in the article, we included a third employment subsystem suitable for the analyzer that is specified as the midpoint between the market-type and internal employment subsystems. We will refer to this employment system as the middle-of-the-road system.

The simplest configurational argument is based on the assumption that the employment systems are ideal types that are equally effective under all conditions (Doty & Glick, 1994). Given this interpretation, greater similarity to any ideal-type employment system will increase organizational performance. To be consistent with this interpretation, we predict that

> *Hypothesis 3: The greater the similarity to the ideal-type employment system that is most similar to an organization's employment system, the higher the financial performance.*

This first configurational assertion is different from traditional universalistic assertions in two ways. First, the configurational assertion relies on a systems perspective and is based on the holistic pattern of HR practices, whereas universalistic assertions are based on the individual HR practices. Second, this configurational assertion includes the assumption of equifinality and implies that multiple employment systems are equally effective for the same set of conditions. Universalistic assertions, in contrast, posit that certain individual HR practices are better in all conditions.

A somewhat more complex configurational interpretation incorporates vertical fit by constraining an organization's choice of employment system to be consistent with the organization's strategy. Thus, the organization must adopt the one ideal type of employment system that is most consistent with the organization's strategy. In other words, the organization must maximize both horizontal and vertical fit. Consistent with this second configurational interpretation, we hypothesize

> *Hypothesis 4: An employment system's similarity to the one ideal-type employment system that is appropriate for an organization's strategy will be positively related to financial performance.*

The second type of configurational assertion is similar to a traditional contingency argument in that both types of arguments assert that the effectiveness of a firm's HR practices are contingent on firm strategy. The configurational assertion differs from a traditional contingency assertion, however, because it retains the notion of discrete, ideal-type employment systems that result in maximal organizational performance. In other words, the second configurational argument is that a given employment system will enhance firm performance only when it is used in association with the appropriate firm strategy. Therefore, the closer the organization's employment system to the one ideal employment system that is congruent with the organization's strategy, the more effective the organization.

The most complex configurational interpretation is that two employment systems, the market type and the internal system, are polar opposites (Kerr & Slocum, 1987; McKinney, 1966) that define a continuum of effective hybrid employment systems. These hybrid employment systems are combinations of the initial ideal-type employment systems. This third configurational interpretation implies that there are an infinite number of effective combinations, or hybrids, of the employment systems that result in horizontal fit. So long as the hybrid employment system an organization implements falls along the continuum, the employment system will be effective. However, the organization must maximize vertical fit in addition to horizontal fit. In order to maximize vertical fit, the extent to which the organization's employment system deviates from the ideal-type employment systems that define the continuum must be exactly proportional to the extent to which the organization's strategy deviates from the ideal-type strategies that are consistent with each ideal-type employment system. For example, if an organization's strategy falls halfway between an analyzer and prospector strategy, then the organization will be maximally effective only if its employment system falls halfway between the market type and middle-of-the-road employment systems. Thus, to maximize performance, the organization must choose the one hybrid employment system that is appropriate for its strategy. Consistent with this argument,

> *Hypothesis 5: An employment system's similarity to the one hybrid employment system that is appropriate for an organization's strategy will be positively related to financial performance.*

This third configurational interpretation is very similar to a traditional contingency assertion. Both types of assertions imply that there are an infinite number of combinations of HR practices that will lead to superior organizational performance if they are used in association with the correct strategy. The primary difference between the two types of assertions involves the relationships between the HR practices and firm strategy. Contingency arguments focus on the relationships between the *individual* HR practices and firm strategy. The configurational assertion, by contrast, retains a system perspective by focusing on the *pattern* of relationships among the HR practices and by constraining the variation in each HR practice to be exactly proportional to the variation in the *system* of HR practices.

Summary

The purpose of this study was to articulate and test three different theoretical frameworks in strategic human resource management. According to the universalistic framework, some HR practices are universally effective. Organizations that adopt these best practices will reap higher profits. In the contingency framework, the effectiveness of individual HR practices is contingent on firm strategy. An organization that adopts HR practices appropriate for its strategy will be more effective. Finally, in the configurational framework there are synergistic effects among HR practices. Thus, consistency within the configuration of HR practices and between the HR practices and strategy are necessary to enhance performance. Empirical tests of these alternate theoretical perspectives are reported in the remainder of this study.

METHODS

Sample and Procedures

The current study was conducted in a single industry to control for between-industry differences. The banking industry was selected for several reasons. First, recent deregulation in this industry is likely to increase the heterogeneity of strategies used across the industry. Some banks offer a wide variety of services to a diverse set of customers; others offer a limited set of services to a largely homogeneous set of customers. Second, a given set of jobs is relatively stable and common across the industry. These common jobs provide some control for between-job variation across banks. Third, government regulations require all banks to report the same types of financial data in a consistent fashion. Thus, the representitiveness of a sample of banks will not be biased by failures to report the financial information on which the dependent variables in the current study are based. These three advantages of the banking industry were thought to compensate for the loss of generalizability that resulted from restricting the study to a single industry.

We selected an initial stratified random sample of 1,050 banks using the following procedure. First, the total population of banks was stratified into three assets categories: assets greater than $25 million and less than or equal to $100 million, assets greater than $100 million and less than or equal to $300 million, and assets greater than $300 million. We then randomly selected 350 banks from each asset category, a process resulting in a total sample of 1,050 banks.

The data from respondents in the banks were collected using two questionnaires. First, one questionnaire was sent directly to a senior HR manager in each bank. The HR questionnaire solicited information about the bank's business strategy and about the HR practices used for specific jobs within the bank. A description of the relevant jobs adapted from the *Dictionary of Occupational Titles* was included with the questionnaire to preclude confusion about the relevant jobs. After the HR questionnaire was returned, we sent a second questionnaire directly to the bank's president. This second questionnaire solicited general information and information about the bank's strategy. (See the Results section for response rates.)

Measures

The design of this study required a wide range of measures collected from four different data sources. Measures of the various HR practices were provided by the HR contact in each bank. Strategy measures were constructed from the data provided by bank presidents. The dependent measures and the control measures were drawn from the Sheshunoff Bank Search database, which contains information obtained from the call reports to the Federal Reserve that all banks must complete quarterly. The values used to construct the ideal strategic profiles necessary for testing the configurational hypotheses were drawn from the values published by Segev (1989). Finally, the values used to construct the ideal HR profiles were specified by the data provided by the HR contact.

HR practices measures. Seven different HR practices were conceptualized and measured. (The Appendix presents the questionnaire items associated with all measures.) Internal career opportunities referred to the extent to which a bank had an internal career ladder or internal career opportunities and was measured as the mean of four 7-point Likert-type items. Higher scores indicated the existence of a well-defined internal career and staffing system with greater opportunities. The degree to which training, both formal and informal, was provided for employees in a job was assessed using the mean of four Likert-type items. Higher scores reflected more extensive and formalized training programs for employees. Appraisal was defined as the degree to which performance appraisals focused on output or results measures rather than on behavioral measures and was calculated as the mean of two items. Higher values represented a greater reliance on results or output measures. Profit sharing was measured with a single item that asked respondents the extent to which employees received bonuses based on an organization's profit. Higher responses represented a greater use of profit sharing in a bank. Employment security was conceptualized as the degree to which an employee could expect to stay in his or her job over an extended period of time and was measured as the mean of four items. Higher scores represented a greater degree of employment security. Employee participation, or voice, was defined as the degree to which employees were allowed to have input into their work and the degree to which the organization valued their input; it was measured as the mean of four items, with higher scores reflecting a greater amount of participation and voice. Finally, job description referred to the extent to which jobs were clearly and precisely defined. This measure was computed as the mean of four items and scored so that higher values reflected a higher degree of job description.

Strategy measures. The design of the current study required two different types of strategy variables. First, a single measure of strategy was required to test the contingency hypotheses. Following previous contingency interpretations of Miles and Snow's theory (Hambrick, 1983, Shortell & Zajac, 1990), we defined the strategic contingency variable as rate of product/market innovation. Innovation was measured as the mean of six Likert-type items adapted from Segev (1989) and presented in the Appendix. A second, larger set of strategy measures was required to test the configurational hypotheses. Thus, in addition to the six previously mentioned items, nine strategy measures adapted from Segev (1989) were included in the questionnaire (see the Appendix). Each of the strategic items included in the questionnaire used a seven-point Likert-type response scale.

Performance measures. The current study incorporated two financial measures important to the banking industry as dependent variables: return on average assets (ROA) and return on equity (ROE). The financial measures were obtained from the Sheshunoff Bank Search database. The measures of ROA and ROE were the year-end measures for 1992, the year in which the surveys were completed.

Control variables. Several control variables were included in the analyses. These data were also obtained from the Sheshunoff Bank Search database. Bank size was measured as the total dollar value of assets. Bank age was the number of years from the founding date. A dummy variable was included to indicate whether a bank was part of a holding company (1 = yes, 0 = no). Finally, we included a series of dummy variables to control for the Federal Reserve district in which a bank was located.

Ideal profiles. Tests of the configurational hypotheses required the construction of two sets of ideal profiles: ideal strategic profiles and ideal employment system profiles. These ideal profiles contain the value of each measure that best characterizes the relevant ideal type (Doty & Glick, 1994). The ideal strategic profiles, operationally defined as the values for each ideal type reported by Segev (1989), are reported in Table 2. We theoretically specified the values for the ideal employment system profiles using the approach initially suggested by Govindarajan (1988) and operationally defined them using the values reported in Table 2. The ideal profile for the middle-of-the-road system was specified as the mean value for each of the relevant variables.

TABLE 2
Values for the Ideal Profiles

(a) Ideal Strategic Profiles Variables	Prospector	Analyzer	Defender
Technological progress	5.64	4.82	4.86
Product/market breadth	5.68	5.18	1.59
Product innovation	6.95	4.68	1.68
Quality	5.47	5.30	5.86
Price level	6.61	4.40	1.32
Active marketing	6.52	5.54	3.14
Long-range financial strength	4.11	5.83	4.88
Resources level	4.86	5.18	4.30
Investment in production	2.91	4.59	6.18
Internal analysis level	3.68	5.62	6.82
External analysis level	6.95	5.24	2.05
Level of risk	6.00	2.62	2.68
Proactive management style	6.76	4.90	2.86
(b) Ideal Employment System Profiles	**Market-Type**	**Middle-of-the-Road**	**Internal**
Results-oriented appraisals	4.44	3.41	2.38
Profit sharing	6.33	4.26	2.19
Job descriptions	3.38	4.49	5.60
Employment security	2.79	3.90	5.01
Internal career opportunities	3.86	4.67	5.48
Training	3.08	4.24	5.40
Participation/voice	4.60	5.36	6.12

The market-type and internal systems were specified as plus or minus one standard deviation from the mean of each variable. This approach ensures that for each variable the relevant position of the employment system is consistent with the substantive theory and that the values for individual profiles are consistent with those for the banks in the sample.

Configurational fit measures. We computed the measures of configurational fit that assessed the similarity of an organization to an ideal profile using the mathematical models presented by Doty and associates (Doty & Glick, 1994; Doty et al., 1993). Ideal-types fit was used to test Hypothesis 3 and was operationally defined as the additive inverse of the deviation between a real organization's employment system and the ideal employment system that the organization most closely resembled. Contingent ideal-types fit, used to test Hypothesis 4, was measured as the additive inverse of the deviation between an organization's employment system and the ideal employment system that was appropriate for the ideal strategic type most similar to the organization's strategy. Finally, contingent hybrid-types fit, used to test Hypothesis 5, was defined as the additive inverse of the deviation between the organization's employment system and a hybrid ideal employment system most consistent with the organization's strategy. In each of the three measures of configurational fit, the computation of the final similarity indexes was restricted to the HR practice measures.

Analysis

A key concept in the SHRM literature is that employment systems should be designed to maximize performance in the jobs that are most critical to an organization's performance. Thus, we limited the current analyses to the job of loan officer because this job was common to all banks, was determined to be one of the most important jobs in banks, and was critical to bank performance (Delery, 1993). The approach taken here is similar to those of Osterman (1994) and Arthur (1992, 1994). Osterman argued that there should be variation in the practices used to manage different employee groups within an organization but that it should be most important to investigate the use of practices for "core" employee groups. Arthur (1992) limited his studies in steel minimills to maintenance and production workers, likely to be the core employees in that context. Limiting the analyses to a single job may reduce the generalizability of results, but the alternative—measuring HR practices as a composite that was a weighted sum of the practices used across broad job catgories—was likely to dilute the observed relationships between the HR practices and organizational performance. Thus, limiting the analyses to a single, critical job in an organization is consistent with prior work and should increase the accuracy of the tests of the relevant theoretical perspectives.

Each hypothesis was tested using hierarchical regression analyses. The tests were based on changes in the level of explained variation before and after the variable of interest was added to the set of control variables. Significant changes in the adjusted R^2 provided support for the hypotheses.

RESULTS

A total of 216 usable questionnaires were returned from the HR contacts. This total represented a 21 percent response rate. These respondents had an average tenure with their banks of 12.24 years and an average tenure in their current jobs of 5.32 years. A total of 114 usable questionnaires were returned from the bank presidents. This total represented a 53 percent response rate from banks that received the second questionnaire and an 11 percent response rate from the overall sample. Bank presidents had an average tenure with their bank of 13.43 years and an average tenure as president of 5.89 years.

Response Bias Check

The analyses used to test the hypotheses in the current study drew on data from multiple sources and thus were based on different sample sizes. Given these differences, we conducted two analyses to check for response bias. First, we assessed whether characteristics of individual banks made their HR managers less likely to complete and return the survey. Following the work of Osterman (1994), we used a logistic regression with the dependent variable defined as a dummy variable coded 1 if an HR director responded and 0 if he or she did not. The independent variables included whether the bank was federally or state chartered, total equity, total deposits, total loans, total cash, total assets, total income, holding company ownership, and age. None of the variables were significant. Next, we investigated whether there were characteristics of banks that made their presidents less likely to complete and return the questionnaire. As above, we used a logistic regression analysis; the variables included in the equation included ROA, ROE, total assets, age, and holding company ownership. Again, no significant differences were detected. The lack of significant results in these two analyses indicated that response bias was not a significant problem in the current data.

Universalistic Hypotheses

Table 3 presents means, standard deviations, correlations, and reliabilities (where appropriate). Moderate correlations between several of the HR practices indicate that these practices are not completely independent. Three of the HR practices are significantly related to either or both ROA and ROE: results-oriented appraisal ($r = .13$, $p < .05$; $r = .09$, $p < .10$), employment security ($r = .17$, $p < .01$; $r = .08$, n.s.), and profit sharing ($r = .22$, $p < .01$; $r = .16$, $p < .01$). These results support some of the relationships specified in Hypothesis 1.

We conducted two additional types of analyses to further test Hypothesis 1. First, ROA and ROE were used as the dependent variables in a set of hierarchical regressions. The seven HR practices were independently entered into the equation after the set of control variables had been entered. These results indicate that three of the seven HR practices explained a significant incremental level of the variance in ROA. The use of results-oriented appraisals was positively related to ROA ($\Delta R^2 = .02$, $F = 4.64$, $p < .05$) and marginally

TABLE 3
Means, Standard Deviations, Reliabilities, and Correlations among Variables[a]

Variables	Mean	s.d.	1	2	3	4	5	6	7	8	9	10	11	12
1. Appraisals	3.41	1.03	(.80)											
2. Job descriptions	4.49	1.13	−.38**	(.78)										
3. Job security	3.90	1.12	−.02	−.25**	(.66)									
4. Career opportunities	4.65	0.82	−.34**	.34**	−.10	(.64)								
5. Training	4.24	1.16	−.24**	.31**	−.10	.41**	(.83)							
6. Participation	5.37	0.77	−.19**	.17**	.00	.30**	.30**	(.80)						
7. Profit sharing	4.28	2.07	.00	−.03	.06	.02	.10	.18**						
8. Assets	12.10	1.28	−.01	.24**	−.31**	.11	.09	−.08	−.14*					
9. Age	66.53	39.27	.05	.07	−.09	.12*	.19**	.12*	−.07	.27**				
10. Holding company	0.53	0.50	−.08	.24**	−.20**	.06	.11	−.04	−.22**	.57**	.22**			
11. Innovation	4.36	0.97	.01	.19*	−.29**	.33**	.23**	.13	.01	.27**	.12	.24**	(.91)	
12. ROA	1.07	0.55	.13*	−.02	.17**	−.07	.01	.03	.22**	−.12*	.12*	.04	−.05	
13. ROE	12.87	7.03	.09†	.03	.08	.00	.08	.06	.16**	−.03	.12*	.20**	.09	.90**

[a] Cronbach's alphas appear on the diagonal for multiple-item measures.

† $p < .10$

* $p < .05$

** $p < .01$

positively related to ROE ($\Delta R^2 = .013$, $F = 3.49$, $p < .10$). This pattern indicates that banks using results-oriented appraisals to manage their loan officers achieved higher returns. Employment security and profit sharing were both positively related to ROA ($\Delta R^2 = .023$, $F = 6.06$, $p < .01$, and $\Delta R^2 = .086$, $F = 24.38$, $p < .001$, respectively), and profit sharing was significantly related to ROE ($\Delta R^2 = .07$, $F = 20.34$, $p < .001$). This result suggests that the greater employment security given to loan officers, the greater the returns to banks. In addition, banks that used profit sharing to a greater extent also performed better.

To further test Hypothesis 1, we entered all the HR practices simultaneously into two hierarchical regression equations, one predicting ROA and one predicting ROE. The results of these two additional analyses, which are presented in Table 4, are entirely consistent with the individual analyses discussed above. When entered simultaneously, the HR practices were able to explain an additional 12.55 percent of variance ($p < .01$) in ROA and an additional 9 percent of variance ($p < .01$) in ROE over what the controls explained. Thus, the results provide relatively strong support for Hypothesis 1.

Results of these two regressions can also be discussed in terms of ROA and ROE. Banks one standard deviation higher than the average on profit sharing are estimated to be 0.17 and 1.96 higher on ROA and ROE, respectively. Additionally, banks one standard deviation higher on results-oriented appraisals and job security are estimated to be 0.08 and 0.09 higher on ROA, and 0.98 and 0.63 higher on ROE. In sum, banks one standard deviation

TABLE 4
Simultaneous Hierarchical Regression Results Testing Hypothesis 1[a]

	ROA		ROE	
Variables	β	ΔR^{2b}	β	ΔR^{2b}
Controls		.28**(.23)		.31**(.25)
HR practices		.13**(.11)		.09**(.07)
Results-oriented appraisals	.14*		.14†	
Profit sharing	.31**		.28**	
Job descriptions	.04		.01	
Employment security	.16**		.09	
Internal career opportunities	.00		.06	
Training	−.01		.00	
Participation/voice	−.07		−.03	
Full equation		.41**(.34)		.40**(.32)

[a] $N = 192$. Controls included 11 dummy-coded variables capturing Federal Reserve district, total assets (log), age, and holding company ownership.

[b] Adjusted R^2 is in parentheses.

† $p < .10$

* $p < .05$

** $p < .01$

higher on all three of these significant HR practices are estimated to be 0.34 higher than average on ROA and 3.57 higher on ROE.

Contingency Hypothesis

Hypothesis 2 states that the relationships between HR practices and performance are contingent on an organization's strategy. These contingency predictions can be evaluated by determining whether an HR practice-strategy interaction term significantly increases the level of explained variation in a hierarchical regression analysis. Thus, we ran a total of 14 hierarchical regression analyses, seven predicting ROA and seven predicting ROE. In the first step of each analysis, the control variables, the strategy measure, and a single HR practice measure were included. In the second step, the interaction term between the single HR practice and the strategy measure was added to the regression equation.

The results indicate that none of the interaction terms significantly increased the explained variation in ROA, and only the appraisal-strategy interaction term explained a significant portion of the variance in ROE ($\Delta R^2 = .038$, $F = 5.55$, $p < .05$). No other interactions were significant. These analyses provide virtually no support for Hypothesis 2.

One explanation for the null results is that the combination of HR practices a firm uses is more important than specific, individual practices. For example, Huselid (1993, 1995) argued that a more accurate assessment of the relationships between HR practices and performance can be made when all HR practices are simultaneously included in analyses. Therefore, we conducted two post hoc hierarchical regressions (one for ROA and one for ROE) in which all seven HR practices were included in the first step and the interaction terms between each of the HR practice measures and the innovation measure were included in the second step.[3] The increase in the level of explained variation was marginally significant for ROE ($\Delta R^2 = .087$, $F = 1.82$, $p < .10$) and approached marginal significance for ROA ($\Delta R^2 = .081$, $F = 1.68$, $p = .13$). Two of the individual interaction terms in the equation predicting ROE and three of the interaction terms in the equation predicting ROA were significant, as were both of the overall equations. Table 5 presents these results. When the interaction terms that were not significant in either equation were removed from the analyses, the interaction between innovation and career opportunities, results-oriented appraisals, and participation explained an additional 7 percent of variance in ROA ($\Delta R^2 = .071$, $F = 3.53$, $p < .05$) and an additional 7.4 percent of the variance in ROE ($\Delta R^2 = .074$, $F = 3.71$, $p < .05$).

An analysis of the interaction terms showed that prospector banks had higher ROA and ROE when using results-oriented appraisals. Conversely,

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[3] We conducted the analyses after mean-centering all variables (Cronbach, 1987; Jaccard, Turrisi, & Wan, 1990; Stone, 1988), because there was relatively high multicollinearity among the independent variables, particularly among the interaction terms.

TABLE 5
Results of the Contingency Regressions[a]

Variables	ROA β	ROA ΔR^{2b}	ROE β	ROE ΔR^{2b}
Controls				
Innovation	−.20	.32**(.21)	−.14	.33**(.21)
HR practices		.10†(.06)		.10†(.06)
1. Results-oriented appraisals	.33**		.35**	
2. Profit sharing	.21*		.19*	
3. Job descriptions	−.08		−.09	
4. Employment security	.19		.15	
5. Internal career opportunities	.01		.04	
6. Training	.00		.08	
7. Participation/voice	.03		.02	
Interactions[c]		.08(.04)		.09†(.05)
Innovation × 1	.22*		.29**	
Innovation × 2	.03		−.06	
Innovation × 3	−.09		−.07	
Innovation × 4	.03		.02	
Innovation × 5	.29*		.26*	
Innovation × 6	−.03		−.09	
Innovation × 7	−.22*		−.17	
Full equation		.43**(.27)		.51**(.32)

[a] $N = 101$. Controls included 11 dummy-coded variables capturing Federal Reserve district, total assets (log), age, and holding company ownership.

[b] Adjusted R^2 is in parentheses.

[c] Numbers refer to HR practices listed above.

† $p < .10$

* $p < .05$

** $p < .01$

defender banks had higher ROA and ROE when relying less on results-oriented appraisals. In a similar fashion, defender banks obtained higher ROA and ROE the more they allowed loan officers to participate in decision making. The reverse was true of prospectors. Finally, ROA and ROE were greatest for prospector banks when there were greater internal career opportunities for loan officers. Again, the reverse was true for defenders.

From the regression equations presented in Table 5, the mean effect on ROA and ROE of having HR practices consistent with strategy was estimated. For instance, the results show that among prospector banks (banks one standard deviation above the mean on the strategy variable), those that were also one standard deviation above the mean on internal career opportunities and results-oriented appraisals were estimated to have an ROE 6.52 higher than those at the mean on those practices.

These post hoc results indicate that there is support for some of the contingency relationships posited in Hypothesis 2. Thus, the contingency perspective should not be rejected out of hand. These results must be viewed with caution, however, given the lack of support for the individual HR practice interaction tests. Future studies will have to investigate these relationships more fully.

Configurational Hypotheses

Prior to testing the configurational hypotheses, we classified each bank according to the ideal employment system it most closely resembled. Table 6 reports the number of banks with employment systems most similar to each ideal employment system and the means and standard deviations of each HR practice for each group of banks. In addition, the F-values reported in Table 6 indicate that there are significant differences among the groups of banks.

The first configurational hypothesis, Hypothesis 3, states that similarity to the one ideal-type employment system most similar to an organization's employment system will be positively related to organizational performance. In other words, if a bank's employment system resembled the market-type system more than other systems, the greater that similarity, the stronger the performance.

To test Hypothesis 3, we first computed the appropriate similarity measure (i.e., ideal-types fit) and then entered this measure in the second step of a hierarchical regression. (The first step of the hierarchical regression contained each of the control variables.) The ideal-types measure of fit did not add significantly to the explained variation in either analysis (ROA: $\Delta R^2 = .008$, $F = 1.91$, n.s.; ROE: $\Delta R^2 = .008$, $F = 1.95$, n.s.). Thus, Hypothesis 3 was not supported.

TABLE 6
Description of HR Types and Comparison of Means[a]

	Employment Systems						
	Market		Middle-of-the-Road		Internal		
HR Practices	**Mean**	**s.d.**	**Mean**	**s.d.**	**Mean**	**s.d.**	***F***
Results-oriented appraisals	4.22	1.07	3.38	0.93	2.84	0.88	18.31**
Profit sharing	6.28	0.85	4.48	1.78	1.62	1.01	80.96**
Job descriptions	3.55	1.27	4.55	1.00	5.06	0.89	20.41**
Employment security	3.44	1.14	3.94	1.06	4.09	1.20	3.43*
Internal career opportunities	4.31	0.79	4.63	0.74	5.14	0.86	10.86**
Training	3.59	1.20	4.25	1.08	4.78	1.22	9.69**
Participation/voice	5.23	0.92	5.35	0.74	5.54	0.69	1.63
Total *N*	32		145		37		

[a] The values reported in this table were computed after each bank was classified according to the ideal employment system it most closely resembled. These values differ from the ideal employment system profiles presented in Table 2 because, unlike ideal system values, the values presented above were calculated after banks had been classified.

* $p < .05$

** $p < .01$

Hypothesis 4 posits that similarity to the one ideal-type employment system that was appropriate for an organization's strategy would be positively related to organizational performance. To test this hypothesis, we computed the contingency ideal-types measure of fit and entered the result into hierarchical regression equations predicting ROA and ROE. The results show that this measure was unable to explain a significant amount of variance in either ROA ($\Delta R^2 = .00$, $F = .00$, n.s.) or ROE ($\Delta R^2 = .002$, $F = .22$, n.s.). Thus, Hypothesis 4 was not supported.

The third configurational hypothesis, Hypothesis 5, predicts that similarity to the one hybrid employment system appropriate for an organization's strategy will be positively related to organizational performance. To test this hypothesis, we computed the contingent hybrid-types measure of fit and then entered this measure into hierarchical regression equations in the same manner as in previous analyses. The results of these regressions do not support Hypothesis 5. Similarity to the appropriate hybrid employment system did not explain a significant amount of variance in either ROA ($\Delta R^2 = .001$, $F = .11$, n.s.) or ROE ($\Delta R^2 = .02$, $F = 2.01$, n.s.).

One plausible explanation for the null results associated with the configurational perspective is that too many or too few ideal employment systems were included in the analyses. Altering the set of ideal types included in the test of a theory can have a substantial effect on the results of the test (Doty, 1994). Thus, prior to abandoning the configurational perspective, we conducted an exploratory post hoc analysis.

The most parsimonious configurational theory would posit that a single ideal employment system will result in maximal organizational performance. To determine if any one of the employment systems described in this article was superior to the others, we calculated the similarity between the organizations' employment systems and each of the ideal employment systems. Each of the similarity measures was then entered into a separate hierarchical regression equation predicting the financial measures. The results of these analyses show that deviations from the internal and the market-type employment systems were both related to ROA ($\Delta R^2 = .03$, $F = 7.33$, $p < .01$; $\Delta R^2 = .06$, $F = 15.51$, $p < .01$) and ROE ($\Delta R^2 = .02$, $F = 5.44$, $p < .05$; $\Delta R^2 = .05$, $F = 13.20$, $p < .01$). The more closely an organization's employment system resembled the market-type system, the higher the ROA and ROE. The reverse was true for the internal system. These results show that ROA and ROE are estimated to be 0.14 and 1.67 higher, respectively, for banks that are one standard deviation from the mean closer to the market-type employment system than the average bank. Although this effect is not nearly as large as those for the universalistic and contingency results, it still represents a sizable difference on these measures.

These results indicate that the market-type system is superior to both of the other two employment systems and provide limited support for the configurational perspective. However, when the individual HR practices were used simultaneously to predict performance, they explained a greater portion of the variation in the dependent variables than did the market-type system. Thus, the market-type system should not be labeled the best system but rather should be viewed as the starting point for constructing an ideal-type employment system in future studies.

DISCUSSION

The results of this study provided relatively strong support for a universalistic perspective and some support for both the contingency and configurational perspectives. Three individual HR practices, profit sharing, results-oriented appraisals, and employment security, had relatively strong universalistic relationships with important accounting measures of performance. Contingency relationships between strategy and three HR practices—participation, results-oriented appraisals, and internal career opportunities—explained a significant portion of the variation in the same performance measures. Finally, similarity to the market-type employment system was also positively related to firm performance. In combination, these results demonstrate that managing human resources as prescribed by each of the different perspectives enhances organizational performance.

It is clear from the statistical analyses that there is strong support for the universalistic perspective. More important, the results of these analyses show that differences in HR practices are associated with rather large differences in financial performance. For instance, financial performance was estimated to be approximately 30 percent higher for banks one standard deviation above the mean on each of the three significant practices than it was for those banks at the mean. These results appear to be even stronger than those of previous research (Huselid, 1995). In addition, the present results are consistent with the theoretical work to date.

The universalistic support for the effectiveness of results-oriented appraisals is consistent with agency theory (Eisenhardt, 1988; Fama, 1980; Fama & Jensen, 1983), control theory (Snell, 1991), and the transaction cost perspective (Jones & Wright, 1992). Each of these theoretical perspectives implies that results-oriented appraisals will enhance performance when measures of the desired results are either readily available or are less costly to obtain than other performance measures. Banks regularly collect and calculate results-oriented measures for the job of loan officer, such as default rate and number of nonperforming loans. Thus, the monitoring costs associated with these measures are extremely low. Behavioral measures for loan officers, on the other hand, are much more difficult to define and expensive to monitor. Each of the three theories implies that the use of behavioral control mechanisms for loan officers would be counterproductive, perhaps as a consequence of these difficulties.

The universalistic relationship between the use of profit sharing and performance also supports both an agency theory and a behavioral theory explanation. Agency theory posits that basing employee rewards on profits ensures that employee interests are aligned with owner interests. The cost of monitoring profits for a profit-sharing plan is negligible because government regulations require banks to report profit measures. In addition, many profit-sharing plans do not distribute profits equally among employees. Instead, profits are distributed differentially according to employee performance. As discussed above, measures of loan officer performance are readily available. In terms of the behavioral perspective, profit sharing may be seen as universalistic because, by definition, all banks strive for profit. By tying individual compensation to organizational profit, the organization is rewarding behavior that is consistent with its overall performance.

The third HR practice that had a universalistic effect on performance was employment security. The effects of employment security are somewhat more difficult to explain in terms of the theories mentioned above. Granting employment security without monitoring employee performance does not assure that employees will engage in the appropriate behaviors. However, employment security may marginally align the interests of employees and owners. If the employees fail to perform in a way that generates continued profits for the organization, the organization may cease to exist, thereby ending the guarantee of employment security. Further, employment security sends a signal that an organization is committed to its workforce. If employees reciprocate this commitment, the organization should have a workforce with a high level of commitment and motivation. This is a key principle behind the rise of high performance–high commitment work systems (Lawler, 1986; Lawler, Mohrman, & Ledford, 1992), and it is the cornerstone of several organizations' HR management strategy. For instance, Lincoln Electric has for many years successfully employed an HR system that is characterized by lifetime employment.

The contingency results provide support for the strategic focus of the SHRM literature. The post hoc analyses revealed that the links between organizational performance and three HR practices—performance appraisal, participation, and internal career opportunities—are contingent on strategy. In general, banks that were able to align their HR practices with strategy are estimated to have nearly 50 percent higher ROA and ROE than those banks whose HR practices were just one standard deviation out of alignment. Specifically, banks that implemented a prospector strategy involving high innovation reaped greater returns from more results-oriented appraisals and lower levels of employee participation than did banks that relied on a defender strategy. Banks implementing a defender strategy performed better if they relied less on results-oriented appraisals and gave their loan officers higher levels of participation in decision making and voice. These findings are consistent with the behavioral perspective of Miles and Snow's (1984) strategic theory.

The direction of the relationship between internal career opportunities and strategy was opposite that hypothesized. Miles and Snow (1984) and Sonnenfeld and Peiperl (1988) both explicitly stated that internal career paths should be more consistent with the defender strategy. The reverse was true in the current study. Prospector banks with more internal career opportunities for their loan officers had higher returns than did defenders. One explanation for this unexpected finding involves the high mobility of talented employees within the banking industry. Talented employees may be likely to change jobs unless their banks offer internal career opportunities. Prospectors were able to keep talent in the organization only if that talent saw future opportunities. In addition, greater opportunities for advancement into a variety of different positions may help prospector banks attract specially skilled employees. Defender banks would most likely not be able to match the variety of opportunities, given their focus on stable markets, and consequently they would focus on other aspects for recruitment. Additional theoretical and empirical work is needed to more fully explore the relationship between internal career opportunities, strategy, and performance.

The configurational results suggest that some configurations of HR practices are better than others. For example, the more closely a bank's employment system resembled the market-type system, the higher its performance. Conversely, HR systems that more closely resembled the internal system resulted in decreased organizational performance. In terms of ROA and ROE, a decrease in distance from the market-type system of one standard deviation from the mean is estimated to result in a 13 percent increase in financial performance.

Our interpretations of the configurational results are the most speculative. First, most configurational theorists argue for multiple effective configurations of the relevant parameters. For example, our a priori arguments and the arguments of Miles and Snow (1984), Sonnenfeld and Peiperl (1988), and others identify multiple maximally effective HR configurations. The configurational analyses we conducted, however, identified a single HR configuration that resulted in better performance. Thus, although the configurational results support the notion that future SHRM researchers should consider employment systems, the current results do not allow us to argue for multiple, equally effective employment systems.

A second limitation to the configurational results presented in this article involves level of explained variation. The key assertion imbedded in configurational theories is that the ideal configurations represent nonlinear synergistic effects of the dimensions used to construct the configurations (Meyer et al., 1993). In the current results, however, the variation explained in the configurational analyses did not exceed the variation explained when the individual dimensions were simultaneously used to predict performance. Thus, we cannot make strong arguments that synergy among the HR practices under investigation enhance organizational performance. So although the configurational approach appears to hold promise for SHRM researchers, additional theory development and testing are necessary to validate the efficacy of the configurational perspective.[4]

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[4] We do not discuss the use of difference scores as a plausible explanation for the null results because the configurational fit methodology differs substantially from the traditional difference score approach. For example, in the current study we calculated the deviation between each real organization and one of two discrete points in multidimensional space. Thus, the point of reference for the deviation analysis associated with the ideal-types model of fit does not vary for each organization in the sample, as it would for the difference score approach. As a result of such substantive differences, many of the limitations typically associated with the use of difference scores are not limitations of the configurational fit methodology.

CONCLUSIONS

The primary purpose of this study was to demonstrate that, contrary to current criticisms, the strategic human resource management literature is not an atheoretical wasteland. We have demonstrated that three different modes of theorizing are incorporated in that literature: universalistic, contingency, and configurational perspectives. The results reported in this study indicate that each of these perspectives is viable and leads to different assumptions about the relationships among HR practices, strategy, and organizational performance. Future theorists should clearly articulate the perspective they are using to structure their arguments and test their arguments with an analytical strategy that is consistent with the relevant perspective.

A second contribution of this study is that it explicitly links characteristics of an organization's employment system to organizational performance. To date, only a few other studies have attempted to make this link. For example, Huselid (1995) and Arthur (1994) showed that HR practices can have a significant impact on organizationally relevant performance measures. Like Huselid's and Arthur's findings, the current findings indicate that some HR practices always have a positive effect on organizational performance. Further, this study is one of the few to document that the relationships between some HR practices and organizational performance are contingent on firm strategy. Thus, the results of the current study suggest different theoretical frameworks are necessary to represent the different forms of relationships between HR practices and organizational performance.

The current study differs from these previous studies, however, because our results suggest a stronger relationship between HR practices and measures of financial performance. Arthur (1992, 1994) did not assess the relationship between HR practices and financial performance, and Huselid's (1995) results explained only 1 to 3 percent of the variation in financial performance. In contrast with these previous studies, the universalistic, contingency, and configurational analyses incorporated in the current study explained as much as 11, 10, and 6 percent, respectively, of the variation in financial performance. Thus, the current work indicates that HR practices may be even more important than was previously suspected. The current results must be interpreted with caution, however, because the inclusion of other determinants of both the HR practices and financial performance may reduce the variation explained by the HR practices alone.

The results of this study also have applied implications for organizations. First, organizations that adopt best HR practices can generate greater returns. Such practices include profit sharing, results-oriented appraisals, and greater employment security. Huselid (1995) pointed out that although organizations may not be able to sustain a competitive advantage because these practices are imitable (Barney, 1991), many organizations are not currently using these more effective practices. Thus, in the short run, organizations that adopt a greater number of these practices are likely to gain a short-term competitive advantage and enjoy superior performance. Pfeffer (1994), however, pointed out that the implementation of these practices is not always an easy task. Therefore, he argued that it is unlikely that organizations can quickly or easily imitate the practices of the best organizations. If this is true, it may be even more important for newly established, or "greenfield," facilities to spend a great deal of time and effort ensuring that their employment systems are in fact consistent with high performance (Ichniowski et al., 1994).

The universal adoption of all HR practices, however, is not completely appropriate. The results presented in this study indicate a more complex relationship between the management of human resources and organizational performance. Some HR practices are more appropriate under certain strategic conditions and less appropriate under others. Thus, the current results support the primary assertion in the SHRM literature. Human resource managers must align some key organizational HR practices with business strategy (Jackson & Schuler, 1995). At least three practices, internal career opportunities, results-oriented appraisals, and participation/voice, may exhibit this contingency relationship. Future research will likely identify other HR practices that must be consistent with an organization's strategy.

Future SHRM research will undoubtedly increase the complexity of the HR manager's job. HR managers should not only keep current with the most effective universalistic practices, but should also be aware of the HR practices that work in concert with the greater goals of the organization's strategy. However, future SHRM research will likely provide more evidence that the manner in which an organization manages its employees has a bottom-line impact. Such research should aid HR managers in their quest to achieve greater status and control in their organizations.

Despite the contributions of this study, several factors limit the generalizability and usefulness of the findings. First, we limited the study to the banking industry to control for between-industry differences. Thus, the results may not be valid in other industries. Although several authors (Huselid, 1995; Pfeffer, 1994) have argued that it is unlikely that the best HR practices vary across industries, the current findings need to be validated in other industries to rule out industry as an important contingency factor. Second, this study was limited to a single job within the banking industry, that of loan officer, selected because it represented a core job within banks and is critical to bank performance. This approach is consistent with previous work (Arthur, 1992, 1994; Osterman, 1994), but characteristics of this job may limit the generalizability of the findings. For example, a loan officer's job is very professionalized and requires considerable training and education. The HR practices that are best for this type of job may differ from those that are best for semiskilled or trade-oriented jobs. Thus, future studies should investigate whether alternative HR practices are better suited for other types of jobs. Third, this study is limited because it included a relatively small set of the population of HR practices currently used by organizations. Although the HR practices included in this research are generally thought to be strategic and were derived from existing theory, other HR practices may constitute best practices, may have important contingency relationships with firm strategy, or may be critical to the specification of alternative ideal configurations of HR practices.

A fourth limitation of this study is the use of a cross-sectional research design. Although we have argued that the effective use of HR practices should lead to stronger performance, our cross-sectional design does not allow us to rule out the possibility that organizations performing well adopt a greater number of high-quality HR practices. The issue of causality can be better addressed in longitudinal designs. Doing so would be an enormous task given the large number of organizations needed; however, we urge future researchers to adopt such designs. Additionally, future studies that include other organizational attributes that are related to both HR practices and organizational performance are needed to provide more accurate estimates of the full effect of HR practices on organizational performance.

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APPENDIX
Measures

Strategy Configurational Items

The Segev (1989) categories appear first, followed by the item or items used for this research.

Technological progress: Is innovative in the way services are delivered.

Product/market breadth: Offers a wide variety of services. Has a very diverse customer group.

Product innovation: Is innovative in terms of the number of new services offered. Is innovative in terms of the novelty of new services offered.

Quality: Offers high-quality services in comparison to the competition.

Price level: Gives customers more for their money than competitors.

Active marketing: Allots a large amount of resources to marketing.

Long-range financial strength: Is able to raise large amounts of financial resources for long-term investments.

Resources level: Has an abundant supply of material resources.

Investment in production: Invests heavily in equipment and facilities.

Internal analysis level: Is able to assess organizational performance, focusing on internal trends and developments.

External analysis level: Is able to systematically track opportunities and threats in the environment in order to design long-range strategies.

Level of risk: Is willing to make commitments which involve many resources and risky projects.

Proactive managerial style: Attempts to shape its environment, as opposed to merely reacting to trends.

Innovation Strategy Measure

Is innovative in the way services are delivered. Offers a wide variety of services. Has a very diverse customer group. Is innovative in terms of the number of new services offered. Is innovative in terms of the novelty of new services offered. Allots a large amount of resources to marketing.

HR Practices

Internal career opportunities: Individuals in this job have clear career paths within the organization. Individuals in this job have very little future within this organization (reverse-coded). Employees' career aspirations within the company are known by their immediate supervisors. Employees in this job who desire promotion have more than one potential position they could be promoted to.

Training: Extensive training programs are provided for individuals in this job. Employees in this job will normally go through training programs every few years. There are formal training programs to teach new hires the skills they need to perform their jobs. Formal training programs are offered to employees in order to increase their promotability in this organization.

Results-oriented appraisals: Performance is more often measured with objective quantifiable results. Performance appraisals are based on objective, quantifiable results.

Employment security: Employees in this job can expect to stay in the organizations for as long as they wish. It is very difficult to dismiss an employee in this job. Job security is almost guaranteed to employees in this job. If the bank were facing economic problems, employees in this job would be the last to get cut.

Participation: Employees in this job are allowed to make many decisions. Employees in this job are often asked by their supervisor to participate in decisions. Employees are provided the opportunity to suggest improvements in the way things are done. Superiors keep open communications with employees in this job.

Job descriptions: The duties of this job are clearly defined. This job has an up-to-date job description. The job description for this job contains all of the duties performed by individual employees. The actual job duties are shaped more by the employee than by a specific job description (reverse-coded).

Profit sharing: Individuals in this job receive bonuses based on the profit of the organization.

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HUMAN RESOURCE MANAGEMENT, MANUFACTURING STRATEGY, AND FIRM PERFORMANCE

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This study examines two alternative views—universal and contingency—of the human resources (HR)-performance relationship in manufacturing settings. Results from a survey of 97 plants primarily support a contingency approach to human resource management (HRM). An HR system focused on human capital enhancement was directly related to multiple dimensions of operational performance (i.e., employee productivity, machine efficiency, and customer alignment), but subsequent analysis revealed that this main effect was predominately the result of linking human-capital-enhancing HR systems with a quality manufacturing strategy. Other manufacturing strategies also moderated the HR-performance relationship.

It has become a widely held premise that people provide organizations with an important source of sustainable competitive advantage (Prahalad, 1983; Pfeffer, 1994; Wright, McMahan, & McWilliams, 1994) and that the effective management of human capital, not physical capital, may be the ultimate determinant of organizational performance (cf. Adler, 1988; Reich, 1991). The value of human capital may be especially apparent in modern manufacturing organizations that have invested heavily in production innovations such as advanced manufacturing technology, statistical process control, and computer numerically controlled machine tools. Such initiatives tend to depend heavily on employee skills and commitment as key components in the value creation process (cf. Snell & Dean, 1992). Accordingly, it is instrumental for manufacturing firms to harness the productive potential of their employees in order to achieve superior performance.

Though human resource (HR) activities are frequently acknowledged to play a central role in linking employee capabilities with the performance

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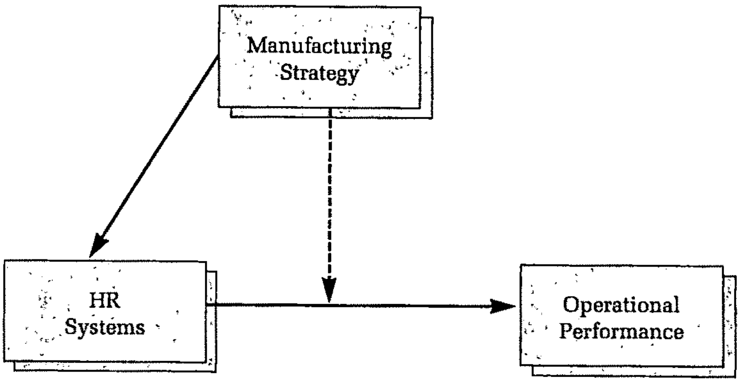
requirements of a firm, the specific form of this relationship is still open to debate. To date, two primary perspectives—a *universal* approach and a *contingency* approach—have been used to describe the link between human resource management (HRM) and firm performance. The universal, or "best practices," perspective implies a direct relationship between particular approaches to human resources and performance, and the contingency perspective posits that an organization's strategic posture either augments or diminishes the impact of HR practices on performance. Analytically, this distinction has been operationally defined as main effects for the universal perspective and as interaction (or moderation) effects for the contingency perspective.

Although on the surface the universal and contingency perspectives may appear to be competing, we would argue that they can be complementary. A good deal of evidence suggests that individual HR practices, as well as internally consistent systems or bundles of HR practices, can indeed directly influence organizational performance (e.g., Arthur, 1994; Huselid, 1995; Kleiner, Block, Roomkin, & Salsburg, 1987; Kochan & Osterman, 1994; MacDuffie, 1995; Osterman, 1994; Pfeffer, 1994; Russell, Terborg, & Powers, 1985; Terpstra & Rozell, 1993). Going beyond these direct HR-performance relationships, however, other evidence suggests that the impact of HR practices on firm performance may be further enhanced when practices are matched with the competitive requirements inherent in a firm's strategic posture (e.g., Cappelli & Singh, 1992; Jackson, Schuler, & Rivero, 1989; Miles & Snow, 1984; Wright, Smart, & McMahan, 1995). In short, the universal approach helps researchers document the benefits of HR across all contexts, ceteris paribus, and the contingency perspective helps us look more deeply into organizational phenomena to derive more situationally specific theories and prescriptions for management practice. Although support for one perspective over another is ultimately an empirical issue, the two perspectives are not necessarily mutually exclusive.

As stated at the outset, these points are particularly germane to ongoing debate within the field of modern manufacturing management. In particular, the jury is still out on the value of "deskilling" versus "upskilling" approaches to HRM in manufacturers (Hirschhorn, 1984; Kern & Schumann, 1990; MacDuffie, 1995; Majchrzak, 1988; Walton & Susman, 1987; Zuboff, 1988). Indeed, many have taken the position that the upskilling or deskilling decision ultimately rides on the particular manufacturing strategy a firm adopts (Klein, 1991; Parthasarthy & Sethi, 1992; Upton, 1995). To date, however, much of the evidence remains anecdotal and continues to blur the distinction between what authors say manufacturers should do and what has actually worked in practice. With these issues in mind, we conducted this study with three overall objectives: to (1) determine the extent to which HR systems directly enhance performance, (2) analyze the moderating effects of manufacturing strategy on the relationship between HR and operational performance, and (3) assess the extent to which particular manufacturing strategies and HR systems are actually used in conjuction with one another

FIGURE 1
Human Resource Management, Manufacturing Strategy, and Performance



across an entire sample of manufacturers. Figure 1 summarizes our research model.

THEORETICAL BACKGROUND AND HYPOTHESES

To explore the relationships among HRM, manufacturing strategy, and performance, we first examine the theoretical and empirical support for both the universal and contingency perspectives.

The Universal Approach to HRM

Over the years, researchers have amassed a fair amount of empirical evidence that certain HR practices can directly affect firm performance. For example, studies show that comprehensive selection and training activities are frequently correlated with both productivity and firm performance (Kleiner et al., 1987; Russell et al., 1985; Terpstra & Rozell, 1993; U.S. Department of Labor, 1993). More recently, researchers have found that bundles, or systems, of HR practices had more influence on performance than individual practices working in isolation (Arthur, 1994; Huselid, 1995; MacDuffie, 1995). An underlying theme in this research is that firms should create a high degree of internal consistency, or fit, among their HR activities. As Baird and Meshoulam emphasized, a firm's HR activities "must fit with and support each other" (1988: 122) if peak organizational performance is to be achieved.

Supporting the HR systems and internal fit viewpoints, Arthur (1992, 1994) found that HR practices focused on enhancing employee commitment (e.g., decentralized decision making, comprehensive training, salaried compensation, employee participation) were related to higher performance. Conversely, he also found that HR practices that focused on control, efficiency, and the reduction of employee skills and discretion were associated with increased turnover and poorer manufacturing performance. Similarly, in a study of high performance work practices, Huselid (1995) found that investments in HR activities such as incentive compensation, selective staffing techniques, and employee participation resulted in lower turnover, greater productivity, and increased organizational performance through their impact on employee skill development and motivation.

Although support for a universal, or best practices, approach to HR exists, there are notable differences across studies as to what constitutes a "best" practice (see Table 1 for a summary of best human resource practices). Nonetheless, several themes emerge across the studies. At their root, most of the studies focus on enhancing the skill base of employees through HR activities such as selective staffing, comprehensive training, and broad developmental efforts like job rotation and cross-utilization. Further, the studies tend to promote empowerment, participative problem solving, and teamwork with job redesign, group-based incentives, and a transition from hourly to salaried compensation for production workers.

The logic connecting these HR practices and firm performance is intuitively appealing and supported by theoretical arguments from a number of disciplines. From micro economics, human capital theory suggests that people possess skills, knowledge, and abilities that provide economic value to firms. Since firm investments to increase employee skills, knowledge, and abilities carry both out-of-pocket and opportunity costs, they are only justified if they produce future returns via increased productivity (Duncan & Hoffman, 1981; Rumberger, 1987; Tsang, 1987). In other words, increased productivity derived from human capital investments depends on the contribution of employees to a firm. Therefore, the higher the potential for employee contribution in a firm, the more likely it is that the firm will invest in human capital (via human resource management activities) and that these investments will lead to higher individual productivity and firm performance (Becker, 1976; Parnes, 1984). As many contemporary manufacturers are said to be increasing the potential for employee contributions in their production equations (Walton & Susman, 1987), human capital theory would suggest that HR practices can directly influence firm performance.

From strategic management and organizational economics, the resource-based theory of competitive advantage focuses on the role internal resources like employees play in developing and maintaining a firm's competitive capabilities (Barney, 1991; Wright & McMahan, 1992; Wright et al., 1994). In fact, numerous researchers have recently noted that *people* may be the ultimate source of sustained competitive advantage since traditional sources related to markets, financial capital, and scale economies have been weakened by globalization and other environmental changes (e.g., Reich, 1991; Ulrich & Lake, 1990). Pfeffer (1994), in particular, has made the case that firms wishing to succeed in today's global business environment must make appropriate HR investments to acquire and build employees who possess better skills and capabilities than their competitors. These theoretical arguments, bolstered by available empirical evidence, point to the performance

TABLE 1
Summary of Best Practices in Human Resources

Freund & Epstein (1984)	Arthur (1992)	Pfeffer (1994)	Delaney, Lewin, & Ichniowski (1989), Huselid (1995)	MacDuffie (1995)
Job enlargement	Broadly defined jobs	Employment security	Personnel selection	Work teams
Job rotation	Employee participation	Selective recruiting	Performance appraisal	Problem-solving groups
Job design	Formal dispute resolution	High wages	Incentive compensation	Employee suggestions
Formal training	Information sharing	Incentive pay	Job design	Job rotation
Personalized work hours	Highly skilled workers	Employee ownership	Grievance procedures	Decentralization
Suggestion systems	Self-managed teams	Information sharing	Information sharing	Recruitment and hiring
Quality circles	Extensive skills training	Participation	Attitude assessment	Contingent compensation
Salary for blue-collar workers	Extensive benefits	Empowerment	Labor/management participation	Status differentiation
Attitude surveys	High wages	Job redesign/teams	Recruiting intensity	Training of new employees
Production teams	Salaried workers	Training and skill development	Training hours	Training of experienced employees
Labor/management committees	Stock ownership	Cross-utilization	Promotion criteria (seniority vs. merit)	
Group productivity incentives		Cross-training		
Profit sharing		Symbolic egalitarianism		
Stock purchase plan		Wage compression		
		Promotion from within		

potential of a universal approach to HR focused on human capital enhancement. Accordingly, they suggest

> *Hypothesis 1: A human-capital-enhancing human resource system will be positively associated with operational performance.*

A Contingency Approach to SHRM

According to the contingency approach to strategic human resource management (SHRM), however, the impact of HR practices on firm performance is conditioned by an organization's strategic posture. For example, at a basic level, one might argue that HR is superfluous to performance in manufacturers unless human capital is somehow a central component of a firm's manufacturing strategy. That is, if a firm's approach to competition depends on, or makes use of, the talents and capabilities of employees, then HR practices would be more likely to have an impact on performance; otherwise the connection between HR and performance might be minimal. Indeed, the prevailing wisdom in manufacturing for many years was to replace labor with physical capital, thereby minimizing the effect that employees could have on performance and effectively removing HR from the production equation (Zuboff, 1988).

Although some firms still compete this way, a variety of strategies are used in contemporary manufacturing settings. In general terms, researchers have made a distinction between "low road" strategies that focus on cost reduction and "high road" strategies tending to focus on quality, variety, or service (Osterman, 1994: 179). Breaking this distinction down further, researchers have typically focused on three primary manufacturing strategies: cost, quality, and flexibility (e.g., Garvin, 1993; Leong, Snyder, & Ward, 1990; Schroeder, Anderson, & Cleveland, 1986; Skinner, 1969; Upton, 1995; Wheelwright, 1981). Each of these strategies, contingency theorists would argue, implies something different about the potential role of human resources in improving firm performance. Such a perspective suggests that the best HR system is contingent on the manufacturing strategy of a firm. A number of theoretical arguments support this position.

According to the behavioral perspective (Jackson et al., 1989; Miles & Snow, 1984; Schuler & Jackson, 1987; Wright & McMahan, 1992), for example, organizational characteristics such as strategy require unique attitudes and role behaviors if performance is to be effective, and HR activities are the primary means used to elicit and reinforce the kinds of employee behaviors a firm requires. Similarly, control theory advocates (e.g., Snell, 1992) contend that effective performance depends on matching appropriate HR practices with the administrative context established by a given strategy. Snell and Youndt (1995) found that the effect of input control, behavior control, and output control on sales growth and return on assets (ROA) was contingent on the clarity of cause-effect relationships and standards of performance (cf. Ouchi, 1977, 1978; Thompson, 1967).

Although the behavioral perspective and control theory tend to focus attention on managing a firm's current employees' behaviors in an effort to maximize performance, firms also focus on competency management through acquiring, developing, and utilizing employees with particular knowledge, skills, and abilities (Wright & Snell, 1991; Wright et al., 1995). More specifically, Wright and his colleagues (1995) found that organizations exhibited higher performance when they recruited and acquired employees possessing competencies consistent with the organizations' current strategies. Reversing the causal arrow, they also found that organizations exhibited higher performance when they sought out a strategy that matched their current employees' competencies (cf. Snow & Snell, 1993). This work provides empirical support for the general assumption that a tighter fit between human resource competencies and strategy leads to superior performance (Baird & Meshoulam, 1988; Miles & Snow, 1984, 1994).

Although these arguments lend credence to the contingency perspective in general, they do not speak directly to the context of manufacturing strategy and performance in particular. Thus, in the following sections we discuss the specific theoretical links we anticipated among manufacturing strategy, HR systems, and operational performance.

Cost strategies. Organizations can create customer value by either reducing costs or increasing benefits in the production equation (i.e., value = benefits/costs). Since people are one of the most costly and uncontrollable resources affecting this equation, the conventional wisdom in manufacturing had been to control costs by diminishing the amount of human capital needed in the production process by substituting mechanized systems for labor. Such technological advances not only have the potential to reduce costs through the elimination of people, but can also suppress the wage levels of remaining employees if the new production systems require lower skill levels and decision-making capabilities (Majchrzak, 1988). In many cases, programmed production systems and highly structured jobs have become de facto methods for deskilling manufacturing workers and reducing their discretion (Helfgott, 1988: 67).

In contexts in which production systems are purposely designed to minimize the impact of individual differences, the most consistent approach to HR would be one based on notions of command and control, where emphasis is placed on efficiently managing a low-skilled, manual workforce. In such settings, the use of elaborate staffing systems, such as comprehensive employment testing, which seeks to find the best qualified candidates, would have a negligible impact on performance (Hofstede, 1978). Furthermore, as work is routinized to the point at which labor is essentially a commodity, the added expense of elaborate training systems would rarely be justified since their utility tends to be diminished (Cascio, 1991). Therefore, training efforts would only need to focus on general information, such as company policies and procedures, or be used as a remedial activity aimed at correcting skill deficiencies, not as a method for driving superior performance.

Performance appraisal would also need to concentrate on areas such as error reduction and process standardization in order to reduce costs and improve efficiency (Majchrzak, 1988). Research suggests that results-based appraisal methods would likely be most appropriate for these purposes (cf. Ouchi, 1977; Snell & Youndt, 1995). However, a developmental approach to appraisal focused on strengthening employee skills and capabilities would likely have minimal utility (as noted, employees are accorded little discretion). At the extreme, appraisal systems would exist merely as perfunctory methods for detecting and correcting errors. As for pay systems, most manufacturers have relied on hourly pay for their lower-level workers in order to maintain control over labor costs (Gomez-Mejia & Balkin, 1992). If incentive compensation were to be used in conjunction with a cost strategy, we would expect it to focus on individual performance since contributions can easily be measured and attributed to specific individuals in standardized production settings (Gerhart & Milkovich, 1993; Gomez-Mejia & Balkin, 1992). In short, administrative HR systems (i.e., selection for manual skills, policies and procedures training, results-based performance appraisal, hourly pay, and individual incentives) are consistent with the requirements of a cost strategy focused on standardizing processes, reducing errors, and maximizing production efficiency.

Quality strategies. In contrast to traditional cost strategies that can encourage deskilling are quality strategies that focus on continually improving manufacturing processes to increase product reliability and customer satisfaction (Fine & Hax, 1985; Garvin, 1993). In such strategic contexts, the ultimate determinant of organizational competitiveness may be the intellectual capital of firms. As Walton and Susman noted, "In plant after plant we see . . . output is more sensitive to variations in human skills, knowledge, and attitudes and to mental effort rather than physical effort" (1987: 99). More specifically, employees in such environments are required to make the transition from *touch labor,* where their responsibilities are limited to only the physical execution of work, to *knowledge work,* where their responsibilities expand to include a richer array of activities such as planning, troubleshooting, problem solving, quality assurance, scheduling, maintenance, and so forth (Ayers & Miller, 1986; Helfgott, 1988; Hirschhorn, 1984; Kern & Schumann, 1990; Shaiken, 1984; Snell & Dean, 1994; Wilkinson, 1983; Zuboff, 1988).

Indeed, most total quality management theorists (e.g., Crosby, 1979; Deming, 1982, 1986) have argued that skill acquisition and development lie at the heart of a successful quality strategy. More specifically, the technical and problem-solving skills of employees tend to be more important in total quality environments (Hayes, Wheelwright, & Clark, 1988) because employees must understand statistical process control (SPC) as well as be able to work in teams to diagnose and solve problems. Reflecting this relationship, selective staffing and comprehensive training programs that emphasize attracting and developing individuals with superior technical, problem-solving, and interpersonal skills should be instrumental for increasing productivity and ensuring conformance to customer requirements.

Though many quality theorists have scorned the use of performance appraisal (cf. Deming, 1986), this disdain has been premised on managers' focus on the results and administrative aspects of evaluation to the exclusion of employee behavioral and developmental issues. More recently, observers such as Blackburn and Rosen (1993) and Ghorpade and Chen (1995) have noted that, in addition to skill development, performance appraisal plays a crucial developmental role in quality-focused organizations. The concept of continuous improvement that underlies most quality initiatives, for example, suggests that diagnosis and employee feedback are required for eliminating defects, increasing product reliability, and conforming to product specifications.

Given the team-based, problem-solving nature of total quality management programs, firms adopting a quality strategy must facilitate employee interaction and information exchange. Researchers (Gomez-Mejia & Balkin, 1992; Pearce, 1987) have contended that group-based performance incentives promote these behaviors in production environments characterized by a high degree of interdependence, where no clear identification of individual contributions can be made. Similarly, a shift from hourly to salaried compensation tends to promote egalitarianism, which facilitates group information sharing and problem solving (cf. Arthur, 1992; Pfeffer, 1994). In summary, human-capital-enhancing HR systems—those with such features as selective staffing, selection for technical and problem-solving skills, comprehensive training, training for technical and problem-solving skills, developmental and behavior-based performance appraisal, group incentives, and salaried compensation—that focus on skill acquisition and development are consistent with the performance requirements underlying a quality strategy.

Flexibility strategies. As more and more manufacturers are achieving low-cost and high-quality market positions, firms are seeking alternative sources of competitive advantage. Increasingly, manufacturers concentrate on flexibility as a way to outdistance their competition (Upton, 1995). In general terms, flexibility refers to a firm's agility, adaptability, and responsiveness. However, flexibility remains a very elusive concept and conjures up many different meanings among manufacturers (Dean & Snell, 1995; Upton, 1995). For example, some firms view flexibility as the ability to scale production up and down quickly in an effort to increase delivery performance, and other firms see flexibility as the ability to quickly expand the scope of their product offerings by producing small lots and accommodating nonstandard orders (DeMeyer, Nakane, Miller, & Ferdows, 1989; Leong et al., 1990).

In the past, many advocates of a flexibility strategy argued that agility and responsiveness could be achieved through sophisticated technologies such as computer-integrated manufacturing (CIM). However, current research findings have shown that manufacturing flexibility depends much more on people than on technical factors per se. As Upton noted,

> Although high levels of computer integration can provide critically needed advantages in quality and cost competitiveness, all the data in my study point to one conclusion: Operational flexibility is determined primarily by a plant's operators and the extent to which managers cultivate, measure, and communicate with them. Equipment and computer integration are secondary (1995: 75).

Consequently, if firms want to successfully pursue a flexibility strategy, they must develop and maintain a highly skilled, technologically competent, and adaptable workforce that can deal with nonroutine and exceptional circumstances requiring creativity and initiative (Adler, 1988; Hayes et al., 1988; Upton, 1995).

The above reasoning suggests that flexibility strategies would likely be complemented by comprehensive staffing systems aimed at acquiring talented employees who possess high levels of both problem-solving and technical skills that allow them to understand an entire production process, thereby facilitating quick production line and product changes (cf. Parthasarthy & Sethi, 1992). Similarly, comprehensive training programs focusing on both problem-solving and technical skills would be advantageous in such environments.

Continuous employee feedback and developmental performance appraisal would likely be of great value to manufacturers pursuing flexibility strategies because unpredictable environments require mutual adjustment for coordination (March & Simon, 1958; Thompson, 1967). Flexibility strategies would also likely benefit from compensation systems that support a multiskilled and adaptable workforce. According to Gomez-Mejia and Balkin (1992), skill-based pay tends to work best in circumstances requiring adaptability, where technology and organizational structure experience frequent changes, and where employee exchanges are common. Thus, skill-based pay should be particularly beneficial to firms seeking to increase their flexibility by frequently scaling up and down production processes, quickly adapting to changes in product mix, routinely handling nonstandard orders, and the like. Additionally, since flexible production environments are characterized by a high degree of employee interdependence and require group problem solving, group-based performance incentives are likely to be appropriate. In short, much like quality strategies, flexibility manufacturing strategies require human-capital-enhancing HR systems that focus on skill acquisition and development in an effort to facilitate adaptability and responsiveness.

The above arguments show that although firms can pursue a multitude of manufacturing strategies, both independently and in concert, each of their strategic orientations implies a somewhat different approach to HR (Jackson et al., 1989). Cost manufacturing strategies tend to focus on internal effectiveness, thereby reducing the impact of human capital on performance. Accordingly, administrative approaches to HR that focus on standardized policies and procedures would likely be most appropriate. On the other hand, quality and flexibility manufacturing strategies tend to require the upskilling of employees, thereby necessitating a human-capital-enhancing approach to HR that focuses on skill acquisition and development. Table 2 summarizes the distinctions between administrative HR systems and those designed to enhance the level of human capital within firms. Taken as a whole, the contingency perspective suggests the relationship between various HR systems and performance depends upon the type of manufacturing strategy being pursued. More specifically,

> *Hypothesis 2: Manufacturing strategy moderates the relationship between human resource systems and operational performance.*
>
> *Hypothesis 2a: A cost manufacturing strategy will positively moderate the relationship between an administrative human resource system and operational performance.*
>
> *Hypothesis 2b: A quality manufacturing strategy will positively moderate the relationship between a human-capital-enhancing human resource system and operational performance.*
>
> *Hypothesis 2c: A flexibility manufacturing strategy will positively moderate the relationship between a human-capital-enhancing human resource system and operational performance.*

In summary, we do not view the universal and contingency perspectives as necessarily competing, and our hypotheses are not set up to convey a critical test between the two. Rather, a universal approach implies a main effect between HR systems and performance, whereas a contingency perspective implies a set of interaction effects between HR systems and manufactur-

TABLE 2
Summary of Administrative and Human-Capital-Enhancing Human Resource Practices

HR Practices	Administrative	Human-Capital-Enhancing
Staffing	Physical skills	Selective staffing Technical skills Problem-solving skills
Training	Policies Procedures	Comprehensive training Technical skills Problem-solving skills
Performance appraisal	Administrative Results-based	Developmental Behavior-based
Compensation	Hourly Individual incentives Internal equity	Salary Skill-based Group incentives External equity

ing strategy as they relate to performance. Of course, both of these conditions can exist simultaneously. In such a situation a main effect is no longer a *general* effect, but rather a *conditional* effect that depends on the specific form of the interactions (Aiken & West, 1991; Jaccard, Turrisi, & Wan, 1990). We explore both the analytical and interpretational implications of this proposition in the sections below.

METHODS

Data and Procedures

A potential pool of 512 manufacturing plants was drawn from several segments of the metal-working industry: primary metals (Standard Industrial Classification [SIC] 33), fabricated metal products (SIC 34), industrial and metal-working machinery (SIC 35), transportation equipment (SIC 36), and precision instruments (SIC 37). We identified plants within these industries using the *Harris Pennsylvania Industrial Directory*. Plants, rather than entire firms, were the units of analysis because manufacturers frequently have several different production facilities that can be managed in very different ways.

General managers. The initial contacts for this study were the general managers of the plants or business units at each site. In the context of a larger research project, we mailed each general manager a cover letter and questionnaire measuring HRM activities and plant performance. After three weeks, a prompting letter and a second questionnaire identical to the first were mailed to all general managers who had not yet responded. A final total of 160 (31 percent) of the general managers participated in the study.

Functional managers. Each general manager was also asked to provide the names of managers in each of four functions: operations, quality, production, and human resources. Of the 160 participating general managers, 123 provided the names of functional managers. We asked each functional manager about the process and content of the selection, training, performance appraisal, and rewards systems used in their organizations. After three weeks, a second letter and questionnaire were mailed to nonresponsive managers. In total, 102 (82 percent) of the operations managers, 109 (89 percent) of the quality, 97 (79 percent) of the production control, and 90 (73 percent) of the HR managers participated.

Approximately one and a half years after the initial surveys were completed, we mailed a second wave of questionnaires to all managers who had responded to the first wave. The questionnaires in this wave measured manufacturing strategy and performance and were identical for all managers. A case was considered valid if we had at least two informants per site for each variable. Using this criteria, our final sample size was 97. A comparison of plants in our final sample with a random sample of nonparticipating plants showed no significant differences in size, unionization, and industry membership (see descriptions of these measures below).

Measures

Because we had multiple respondents for each variable, mean values across respondents were used in all cases for subsequent analysis. To make certain that data could be aggregated to the plant level, we calculated interrater agreement (IRA) according to the methods prescribed by James, Demaree, and Wolf (1984, 1993). (For further discussions of r_{wg} as a measure of interrater agreement, see Kozlowski and Hattrup [1992] and Schmidt and Hunter [1989]).

Operational performance. Operational performance was measured in both waves of questionnaires and assessed each firm's current performance relative to other firms in its industry in terms of product quality, employee morale, on-time delivery, inventory management, employee productivity, equipment utilization, production lead time, and scrap minimization. For the purposes of this study, we chose to use self-report performance measures for several reasons. First, since our study focused on plants, many of which were cost centers as opposed to profit centers, objective financial performance measures were unavailable for our entire sample. Second, because of the cross-industry nature of our sample, standardized measures of these dimensions were unavailable for comparisons. Accordingly, we followed Beard and Dess (1981) and asked managers to assess their own plant's performance relative to that of rivals within their industry.

Recognizing the potential problems with self-report measures, we took several steps to ensure the reliability and validity of the indexes used in this study. In accordance with past research, we averaged the performance measures for the two time periods (t, t + 1.5 years) to help guard against random fluctuations and anomalies in the data. In addition, to minimize other effects from random error, we used multiple items and multiple respondents to assess performance. Although any single item or observation contains true variance as well as systematic and random error, averaging across alternative measures reduces the random error component.

Beyond issues of reliability (such as random error), systematic error that might detract from the validity of our performance measures was also a concern. To ensure content validity, we used a representative sample of items from the entire construct domain of operational performance: product quality, employee morale, on-time delivery, inventory management, employee productivity, equipment utilization, production lead time, and scrap minimization. As in other research focused on the performance construct, these measures include both indicators of efficiency and effectiveness (cf. Venkatraman & Ramanujam, 1986). To assess the convergence and divergence among these items (i.e., construct validity), we used principal components factor analysis with varimax rotation to determine the underlying dimensionality of our performance measures. A two-stage rule was used to categorize items into factors (cf. Nunnally, 1978). First, to make certain that a given item represented the construct underlying each factor, we used a factor weight of .40 as the minimum cutoff. Second, to avoid problems of cross-loadings, we required that each item be clearly defined by only one factor. Operationally, if the difference between weights for any given item was less than .10 across factors, we deleted the item from the final scale. Each of the performance items met these criteria. The final factor structure revealed three stable factors representing *machine efficiency* (e.g., equipment utilization, scrap minimization), *customer alignment* (e.g., product quality, on-time delivery), and *employee productivity* (e.g., employee morale, employee productivity). Each factor's eigenvalue and Cronbach alpha exceeded 1.00 and .60, respectively.

Human resource management practices. The HR practices used in this study focused on the four most commonly recognized areas of HRM: staffing, training, performance appraisal, and compensation. *Staffing* practices included four different scales used to measure (1) selectivity in hiring, (2) selection for manual and physical skills, (3) selection for technical skills, and (4) selection for problem-solving skills. *Training* practices also included four different scales used to measure (1) comprehensiveness, (2) policies and procedural training, (3) training for technical skills, and (4) training for problem-solving skills. *Performance appraisal* practices included three different scales used to measure (1) developmental focus, (2) results-based appraisal, and (3) behavior-based appraisal. *Compensation systems* included (1) hourly pay, (2) salary, (3) skill-based pay, (4) individual incentives, (5) group incentives, (6) individual equity, and (7) external equity.

To empirically validate our multi-item scales, we performed confirmatory factor analysis using maximum likelihood extraction (Jöreskog & Lawley, 1968). Separate factor analyses were performed for each HR area (i.e., staffing, training, performance appraisal, and compensation) in order to maintain appropriate sample-size-to-factor ratios (Nunnally, 1978). Following the procedures recommended by Gorsuch (1983), we used a series of chi-square tests to confirm the a priori factor structure of our measures (staffing, $\chi^2 = 370.78$, $p < .01$; training, $\chi^2 = 415.97$, $p < .01$; appraisal, $\chi^2 = 451.02$, $p < .01$; compensation, $\chi^2 = 267.83$, $p < .01$). This analysis as well as scree tests (Cattell, 1966) of eigenvalues plotted against factors confirmed our proposed factor structure. Each factor's eigenvalue and Cronbach alpha exceeded 1.00 and .70, respectively.

Next, we followed the procedures used by MacDuffie (1995), Osterman (1994), and Arthur (1992, 1994) to combine the HR practices into two aggregate indexes reflecting (1) the administrative HR system and (2) the human-capital-enhancing HR system. Such an additive approach to combining HR practices into an index suggests that firms can improve performance either by increasing the number of practices they employ within the system or by using the practices in an HR system in a more comprehensive and widespread manner. This approach is conceptually and empirically better than a multiplicative approach to creating HR systems because it does not reduce the index value to zero if a single HR practice is absent from a system. Instead, the absence of a practice only weakens the net effect of the system (MacDuffie, 1995; Osterman, 1994).

Specifically, the index for the administrative HR system included the following scales: selection for manual and physical skills, policies and procedures training, results-based performance appraisal, individual equity, individual incentives, and hourly pay. The index for the human-capital-enhancing HR system consisted of the following: selective staffing, selection for technical and problem-solving skills, comprehensive training, training for technical and problem-solving skills, developmental and behavior-based performance appraisal, external equity, group incentives, skill-based pay, and salaried compensation. As noted earlier, these groupings are based on normative theory derived from previous studies on the strategic management of human resources (e.g., Arthur, 1992, 1994; Huselid, 1995; MacDuffie, 1995; Pfeffer, 1994). Cronbach alphas for the administrative HR system and the human-capital-enhancing system were .61 and .68, respectively.

Manufacturing strategy. Manufacturing strategy was measured by 31 items that operationally defined potential competitive priorities in manufacturing, including cost, quality, and flexibility. As there are minor differences in the sets of manufacturing strategies used by various authors, we used principal components factor analysis with varimax rotation to determine the underlying dimensionality of our manufacturing strategy measures. Again, a two-stage rule was used to assign items to factors (cf. Nunnally, 1978).

This analysis produced four stable factors representing quality, delivery flexibility, scope flexibility, and cost, each of which had a eigenvalue above 1.00 and a Cronbach alpha greater than .70. The first factor, *quality,* was comprised of virtually every quality-related item on our list (e.g., dependability, product performance). Two additional quality-related items, solving customer problems immediately and meeting customer expectations, loaded both on quality and a second factor and thus were not included in this scale. The second strategy dimension, *delivery flexibility,* involved releasing new products and making deliveries on time, scaling production up or down quickly, and generally being flexible. Interestingly, the high productivity item also loaded on this factor, perhaps indicating the cost advantages of doing things quickly (cf. Stalk & Hout, 1990). The third dimension, *scope flexibility* (Parthasarthy & Sethi, 1992), contained items related to adjusting product mix, handling nonstandard orders, and making products to order in small lots. The final dimension, *cost,* was made up of items dealing with low labor, material, and unit costs. This categorization of manufacturing strategies parallels those in the literature (e.g., Leong et al., 1990; Marucheck, Pannesi, & Anderson, 1990; Schroeder et al., 1986; Skinner, 1969; Upton, 1995; Wheelwright, 1981). As flexibility is a somewhat vague and developing construct (Upton, 1995), it is not surprising that we found two distinct dimensions of flexibility.

Organizational size. Since large organizations may be more likely than small ones to have well-developed HR practices, we controlled for any extraneous effects of organizational *size.* Following Kimberly (1976), size was measured as the natural logarithmic transformation of the number of full-time employees, which was obtained from Standard & Poor's *Directory of Corporate Affiliations.*

Industry environment. We included three additional variables in the study in order to eliminate their extraneous effects prior to examining our hypotheses. The first was *munificence.* Following Keats and Hitt (1988), we assessed growth in each industry by regressing the natural logarithm of sales against time. The antilog of the regression slope was used as an index of munificence. For *dynamism,* we used the antilog of the standard error term from each regression equation described above to assess the degree of change in industry sales. For *complexity,* the MINL formula (Schmalensee, 1977) of sales concentration was used as a surrogate for the H-index of complexity. Sources for this data were the *Commerce Department's Survey of Manufactures* and *Moody's Industrials.*

RESULTS

Table 3 shows the means, standard deviations, interrater agreements, and correlation matrix for all variables.

Hypothesis Testing

To test our specific hypotheses, we used moderated hierarchical regression analysis in order to isolate the main effects of the HR systems on performance and to independently assess how each manufacturing strategy moderated the relationship between HR and performance. Our overall procedure for each dependent performance variable (i.e., customer alignment, employee productivity, and equipment efficiency) was the same. In step 1, the three environmental variables (i.e., munificence, complexity, and dynamism) and firm size were added as a set. We added these variables first to control for any extraneous effects across industries and organizations. In step 2, the set of manufacturing strategies (i.e., cost, quality, delivery flexibility, and scope flexibility) were entered in order to control for any effects strategy might have on HR systems, operational performance, or their relationship. Significant effects here would indicate a direct relationship between manufacturing strategy and performance. In step 3, the two HR systems (i.e., administrative HR and human-capital-enhancing HR) were entered as a set to test the universal approach to HR. A significant effect here between a human-capital-enhancing HR system and operational performance would provide support for Hypothesis 1. In addition, this procedure eliminated the main effects of HR systems prior to examining potential HR-strategy interaction effects (cf. Stone & Hollenbeck, 1989). Finally, in step 4, the cross products of each of the manufacturing strategies and the HR systems (e.g., cost by administrative HR, cost by human-capital-enhancing HR, quality by administrative HR, quality by human-capital-enhancing HR) were entered as a set. Entering the eight interaction terms simultaneously controlled for possible multicollinearity among the variables. Evidence of moderation exists when the set of interaction terms accounts for significant residual variance in the dependent variable. Significant effects here would indicate that manufacturing strategy

TABLE 3
Descriptive Statistics[a]

Variables	Mean	s.d.	IRA[b]	1	2	3	4	5	6	7	8	9	10	11	12
1. Munificence	1.08	0.06													
2. Complexity	7.24	11.23		−.25											
3. Dynamism	1.02	0.02		.85	−.14										
4. Size	7.28	2.21		.02	.02	.08									
5. Customer alignment	3.65	0.51	.87	.16	.13	.07	−.05								
6. Employee productivity	3.32	0.59	.91	.03	.03	.03	.01	.39							
7. Machine efficiency	3.17	0.53	.92	.17	−.04	.15	.18	.33	.31						
8. Quality strategy	5.62	0.71	.94	.07	.07	.03	−.18	.46	.17	.27					
9. Delivery flexibility strategy	4.91	0.73	.94	.04	−.04	.01	−.06	.39	.42	.10	.49				
10. Scope flexibility strategy	4.80	0.88	.88	−.14	−.09	−.11	−.17	.04	.22	−.07	.17	.44			
11. Cost strategy	4.75	0.83	.81	.08	−.09	.02	.07	.15	.12	−.02	.02	.26	−.13		
12. Administrative HR	3.28	0.68	.83	.08	−.04	.11	.07	.26	.27	.14	.08	−.02	.02	.05	
13. Human-capital-enhancing HR	2.80	0.59	.86	−.03	.12	−.02	.11	.32	.38	.27	.27	.00	−.09	−.03	.56

[a] $N = 97$. Correlations greater than .20 are significant at $p < .05$; correlations greater than .27 are significant at $p < .01$.

[b] IRA = interrater agreement.

moderated the relationship between HR systems and performance, thereby providing support for Hypothesis 2. We used individual interaction terms (e.g., cost by administrative HR) to test our specific moderation hypotheses (2a, 2b, and 2c). Support for these hypotheses would exist if the individual interaction terms accounted for significant residual variance in operational performance. Tables 4–6 show the results of our moderated hierarchical regression analyses.

Main effects/universal approach. With industry environment, firm size, and manufacturing strategy controlled, the HR systems as a set were significantly related to customer alignment ($\Delta R^2 = .07$, $F = 4.60$, $p < .01$) and employee productivity ($\Delta R^2 = .14$, $F = 8.68$, $p < .01$). Specifically, the human-capital-enhancing index had a significant main effect on employee productivity ($b = 0.36$, $p < .01$) and was marginally associated with customer alignment ($b = 0.18$, $p < .10$) and equipment efficiency ($b = 0.20$, $p < .10$). Overall, these findings provide preliminary support for Hypothesis 1 and suggest that, other things being equal, an HR system focused on enhancing human capital is a valuable approach for strengthening operational performance in manufacturing.

Moderating effects/contingency approach. Beyond the direct relationships between human-capital-enhancing HR and performance, we also found support for the contingency approach to HR. As a set, the manufacturing strategy–HR interaction terms accounted for significant incremental variance in customer alignment ($\Delta R^2 = .12$, $F = 2.20$, $p < .05$). This result indicates that manufacturing strategy does in fact moderate the HR-performance relationship, thereby providing support for Hypothesis 2, the basic moderation hypothesis. In testing the more specific moderation hypotheses, we found that a cost strategy interacts with an administrative HR system to predict equipment efficiency ($b = 0.81$, $p < .05$), thereby providing some support for Hypothesis 2a. Additionally, a quality strategy interacted with the human-capital-enhancing HR system to predict customer alignment ($b = 2.70$, $p < .05$), employee productivity ($b = 2.42$, $p < .05$), and equipment efficiency ($b = 2.90$, $p < .05$), thereby providing consistent support for Hypothesis 2b. Finally, delivery flexibility interacted with an administrative HR system to predict customer alignment ($b = 1.41$, $p < .05$). This result was counter to our anticipated results and therefore provides no support for Hypothesis 2c. Overall, however, the moderation results provide strong evidence that manufacturing strategy influences the HR-performance relationship with a quality strategy interacting with human-capital-enhancing HR to predict performance and delivery flexibility and cost strategies interacting with administrative HR to predict performance. In short, maximizing performance appears to depend on properly aligning HR systems with manufacturing strategy.

As we stated earlier, main effects become conditional in the presence of significant interactions (Aiken & West, 1991; Jaccard et al., 1990). Accordingly, we went back and revisited the universal findings for human-capital-enhancing HR. Plotting the interactions of human-capital-enhancing HR and a quality strategy showed clearly that although human-capital-enhancing HR

TABLE 4
Results of Regression Analysis for HR Systems, Manufacturing Strategy, and Customer Alignment[a]

Variables	Step 1	Step 2	Step 3	Step 4
Control				
Size	−0.04	0.02	−0.02	−0.08
Munificence	0.48*	0.35*	0.36*	0.43*
Complexity	0.22*	0.18*	0.17*	0.21*
Dynamism	−0.29	−0.22	−0.24	−0.30†
Manufacturing strategies				
Cost strategy		0.07	0.05	0.04
Quality strategy		0.34**	0.25*	−0.72
Delivery flexibility strategy		0.23*	0.27*	−0.23
Scope flexibility strategy		−0.06	−0.06	0.25
Human resource management systems				
Administrative HR			0.14	−0.13
Human-capital-enhancing HR			0.18†	−1.61†[b]
Strategy/HR interactions				
Cost × administrative HR				0.21
Cost × human-capital-enhancing HR				−0.18
Quality × administrative HR				−0.42
Quality × human-capital-enhancing HR				2.70*
Delivery × administrative HR				1.41*
Delivery × human-capital-enhancing HR				−0.63
Scope × administrative HR				−0.85*
Scope × human-capital-enhancing HR				0.35
ΔR^2		0.22	0.07	0.12
R^2	0.09	0.31	0.38	0.50
ΔF		7.55**	4.60**	2.20*
F	2.24†	5.21**	5.42**	4.32**

[a] $N = 97$. Standardized regression coefficients are shown.

[b] The main effects in step 4 of our regression equations are simply the effect of human-capital-enhancing HR on performance when manufacturing strategy is zero. This fact creates interpretation problems since our interval scales do not include a zero value. Theoretically, it may be useful to think of a world in which manufacturing strategy equals zero but, as Tate (1984) and other have suggested, it only makes practical and statistical sense to examine conditional main effects over the range of one's data. Accordingly, we transformed our data and performed some exploratory analysis calculating human-capital-enhancing HR coefficients in the full regression model across the relevant range of strategy levels present in our sample. This analysis yielded all positive coefficients for human-capital-enhancing HR, thereby indicating that the conditional main effect of such HR practices on performance is positive across the applicable levels of manufacturing strategy in our sample.

† $p < .10$

* $p < .05$

** $p < .01$

has a slight positive main effect, the results are primarily due to the large performance impact of linking human-capital-enhancing HR with a quality manufacturing strategy (see Figure 2). These findings imply that it is misleading to suggest that human-capital-enhancing HR has a general main effect on performance.

TABLE 5
Results of Regression Analysis for HR Systems, Manufacturing Strategy, and Employee Productivity

Variables	Step 1	Step 2	Step 3	Step 4
Control				
Size	−0.04	−0.01	−0.07	−0.12
Munificence	0.25	0.18	0.20	0.16
Complexity	0.13	0.13	0.11	0.10
Dynamism	−0.15	−0.09	−0.10	−0.10
Manufacturing strategies				
Cost strategy		0.11	0.12	−0.17
Quality strategy		0.13	−0.02	−0.89
Delivery flexibility strategy		0.21†	0.28*	0.12
Scope flexibility strategy		0.02	0.04	−0.04
Human resource management systems				
Administrative HR			0.08	0.32
Human-capital-enhancing HR			0.36**	−2.16*
Strategy/HR interactions				
Cost × administrative HR				0.41
Cost × human-capital-enhancing HR				0.09
Quality × administrative HR				−0.41
Quality × human-capital-enhancing HR				2.42*
Delivery × administrative HR				−0.09†
Delivery × human-capital-enhancing HR				0.39
Scope × administrative HR				−0.18
Scope × human-capital-enhancing HR				0.23
ΔR^2		0.12	0.14	0.07
R^2	0.03	0.15	0.29	0.36
ΔF		3.14*	8.68**	1.13
F	0.71	1.96†	3.57**	2.52**

[a] $N = 97$. Standardized regression coefficients are shown.
† $p < .10$
* $p < .05$
** $p < .01$

Additional Analyses

In addition to the above hypothesis-testing procedures, two additional analyses were conducted to supplement our findings. First, recognizing that manufacturing strategies are used in combination rather than in isolation, we performed cluster analysis on the four manufacturing strategies orientations. This analysis yielded five clusters that we labeled (1) quality emphasis, (2) cost and quality emphasis, (3) cost, quality, delivery flexibility, and scope flexibility emphasis, (4) quality and delivery flexibility emphasis, and (5) no strategic emphasis. We repeated our regression analyses procedures substituting these strategy clusters for the individual strategy variables. These regressions provided no evidence that the strategy clusters directly impacted manufacturing performance or interacted with HR practices to predict performance.

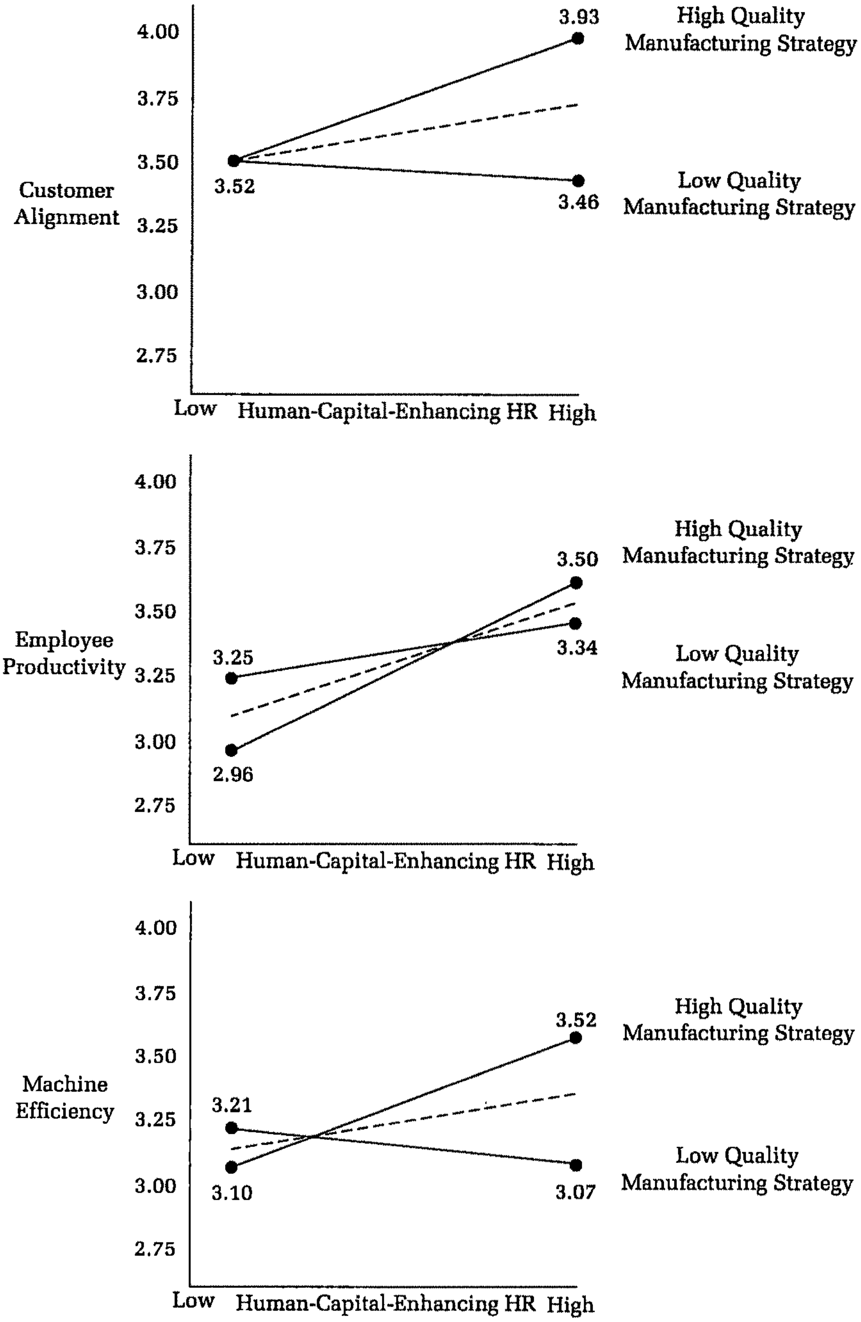
TABLE 6
Results of Regression Analysis for HR Systems, Manufacturing Strategy, and Equipment Efficiency

Variables	Step 1	Step 2	Step 3	Step 4
Control				
Size	0.18†	0.23*	0.20*	0.14
Munificence	0.19	0.13	0.14	0.11
Complexity	0.00	−0.04	−0.06	−0.07
Dynamism	−0.03	−0.01	−0.00	0.02
Manufacturing strategies				
Cost strategy		−0.06	−0.06	−0.27
Quality strategy		0.33**	0.25*	−0.75
Delivery flexibility strategy		0.01	0.02	0.40
Scope flexibility strategy		−0.09	−0.07	−0.01
Human resource management systems				
Administrative HR			−0.01	0.09
Human-capital-enhancing HR			0.20†	−1.47
Strategy/HR interactions				
Cost × administrative HR				0.81*
Cost × human-capital-enhancing HR				−0.40
Quality × administrative HR				−0.67
Quality × human-capital-enhancing HR				2.90*
Delivery × administrative HR				−0.65
Delivery × human-capital-enhancing HR				0.12
Scope × administrative HR				0.54
Scope × human-capital-enhancing HR				−0.66
ΔR^2		0.10	0.03	0.09
R^2	0.06	0.16	0.19	0.28
ΔF		2.69*	1.63	1.15
F	1.55	2.18*	2.09*	1.70*

[a] $N = 97$. Standardized regression coefficients are shown.
† $p < .10$
* $p < .05$
** $p < .01$

Second, we wanted to assess the extent to which particular HR systems and manufacturing strategies were actually used in conjunction with one another across the entire sample of participating firms. Accordingly, we regressed each HR system on the four manufacturing strategies, again controlling for industry environment and firm size. The strategies as a set were predicitive of the human-capital-enhancing HR system ($\Delta R^2 = .11$, $F = 2.97$, $p < .05$), with the quality strategy ($b = 0.39$, $p < .05$) being positively associated with the human-capital-enhancing HR system. However, the manufacturing strategies as a set were not predictive of the administrative HR system ($\Delta R^2 = .02$, $F = 0.56$, n.s.). These results suggested that, with the exception of those employing a quality strategy, firms were not making a consistent connection between the manufacturing strategies they pursued and the HR systems they employed. This finding is somewhat surprising

FIGURE 2
Human-Capital-Enhancing HR and Quality Manufacturing Strategy Interactions



given the strong relationships among HR, manufacturing strategy, and performance.

DISCUSSION

Overview and Implications of Findings

The purpose of this study was to examine both the universal and contingency approaches to HR and performance in a manufacturing environment. At the outset, we stated that theoretically and empirically these two approaches—in and of themselves—are not necessarily incompatible. It is possible to have both main effects supporting the universal perspective and contingency effects supporting the contingency perspective. This argument not withstanding, our analysis shows that the apparent main effect of human-capital-enhancing HR on performance is predominately a function of the performance enhancements obtained when firms link human-capital-enhancing HR systems with a quality manufacturing strategy. Accordingly, it is not accurate to conclude from our study that there are strong universal or best practices approaches to human resource management. Instead, our findings provide much more support for the contingency perspective. In the next section, we discuss the specific contingency findings uncovered in the current study.

Contingency approach to HR. Given the consistent interactions between a quality manufacturing strategy and the human-capital-enhancing HR system as they relate to customer alignment, employee productivity, and equipment efficiency, we would argue that systematic efforts to enhance the skill levels of employees are especially important to firms trying to compete on quality. Although this idea has been well articulated in the total quality literature (e.g., Crosby, 1979; Deming, 1986), our results add clarity to the specific aspects of operational performance affected by human-capital-enhancing HR systems. It appears that in such production environments, human-capital-enhancing HR systems designed to develop talented and team-oriented workers improve employee productivity, machine efficiency, and customer satisfaction.

These findings parallel anecdotal evidence from companies such as Motorola, Nucor Steel, and Southwest Airlines that have used selective staffing, comprehensive training, and other skill development efforts as centerpieces in their quests to improve performance through total quality management initiatives (cf. Pfeffer, 1994). Moreover, the results suggest HR practices designed to professionalize employees and create an egalitarian work environment positively influence operational performance when matched with quality manufacturing strategies. Such findings coincide with the arguments of scholars (e.g., Lawler, Mohrman, & Ledford, 1992; Majchrzak, 1988) who promote the use of salaried compensation and increased employee problem solving as a means to foster egalitarianism. They also lend credence to the employee skill development and professionalization efforts of quality-focused companies, such as Saturn and Chaparral Steel, which promote increased employee problem solving, incorporate group incentives into their reward systems, and use salaried compensation on their plant floors (Armstrong, 1990; Dumaine, 1992).

In addition to the quality strategy and human-capital-enhancing HR system link, our findings indicate that an administrative HR system interacts with a cost manufacturing strategy to enhance employee productivity and also works in conjunction with a delivery flexibility strategy to improve customer alignment. These findings suggest that administrative HR systems are still very appropriate in strategic contexts that emphasize reducing costs and eliminating uncontrollable behavior. Although we hypothesized that flexibility strategies would require upskilled employees, it may in fact be the case that a delivery flexibility strategy can be based on flexible machines rather than flexible jobs (cf. Jaikumar, 1986). Such an environment likely necessitates standardized and routine behaviors and is therefore very consistent with a cost strategy. As Klein pointed out, such an approach to manufacturing "can turn workers into extensions of a system no less demanding than a busy assembly line" (1991: 61). In short, our findings suggest that administrative HR systems can be used in standarized production contexts to increase productivity and customer alignment.

There was only one instance in our contingency analysis in which a manufacturing strategy–HR combination was associated with diminished performance. Specifically, a scope flexibility strategy interacted negatively with an administrative HR system to affect customer alignment. Unlike *delivery* flexibility (which showed a positive interaction with the administrative HR system), *scope* flexibility involves adapting to changes in product mixes and handling difficult and nonstandard orders. From our findings, it appears that this strategy requires an HR system that allows for more employee discretion and requires high employee skill levels (Upton, 1995). Although only a minor trend in our results, this particular finding highlights the importance of separating different aspects of a flexibility strategy. Scope and delivery flexibility are different conceptually, and they seem to demand very different approaches to HR management.

Descriptive analysis. Since our analyses revealed that combining HR and manufacturing strategy could either enhance or hinder performance, we wanted to determine—from a purely descriptive standpoint—whether the actual practices of all manufacturers reflected these findings. In practice, the only HR-manufacturing strategy link we found across the entire sample was between the human-capital-enhancing HR system and a quality strategy. This finding indicates that manufacturers are capitalizing on the opportunity to improve performance by combining human capital enhancement with a quality strategy but are missing out on the benefits gained by linking administrative HR systems with manufacturing strategies emphasizing cost containment and delivery flexibility.

Several explanations may account for these findings. On the one hand, both practitioners and academics have spent considerable time trying to understand how firms can successfully implement quality strategies and have overwhelmingly concluded that quality initiatives tend to fail unless they are combined with employee skill-building efforts (e.g., Blackburn & Rosen, 1993; Crosby, 1979; Deming, 1986). On the other hand, there still remains much debate about how to effectively manage people in production environments pursuing cost containment through the introduction of technology. For example, some studies (e.g., Helfgott, 1988; Kern & Schumann, 1990; Spenner, 1983) encourage the use of human-capital-enhancing HR systems that facilitate teamwork and upgrade the technical and problem-solving skills of employees, and others (e.g., Butera & Thurman, 1984; Gerwin & Tarondeau, 1982; Shaiken, 1984) suggest a more traditional administrative approach to HR. Anecdotal observations (e.g., Walton & Susman, 1987) seem to indicate that many of today's manufacturers are moving toward the former view. Our results, however, indicate that administrative HR systems focused on standardized procedures, results-based performance appraisal, individual incentives, and the like may still be very appropriate for manufacturers pursuing cost containment.

The lack of a connection between delivery flexibility and an administrative HR system is not particularly surprising. A good deal of ambiguity currently surrounds the general concept of flexibility in both the academic literature and manufacturing organizations. And although numerous studies (Gupta & Somers, 1992; Sethi & Sethi, 1990) have attempted to outline the differing dimensions of manufacturing flexibility, there still remains a high degree of uncertainty about how to manage people to promote flexibility (Upton, 1995). Furthermore, as this study indicates, it appears that different types of flexibility require different people management systems, making the task of connecting flexibility strategies and human resources all the more difficult.

Limitations and Suggestions for Future Research

The limitations of this study constrain our interpretation of the findings and point to several issues for future research. First, this study only examined cross-sectional differences among manufacturing firms. Gaining a clearer understanding of the relationships between HR systems, strategy, and performance will require longitudinal analysis. Though we examined these relationships in terms of HR systems adapting to the strategic requirements of firms, the opposite is possible as well. Indeed, researchers have suggested that firms may wish to adapt their strategies to complement their human infrastructures (Snow & Snell, 1993; Wright et al., 1995). Likewise, though we have suggested that HR systems and their match with strategy lead to performance, it is reasonable to contend that HR has a lagged effect. That is, successful firms possess the slack resources required to invest in the best HR practices. Future research might look at HR, strategy, and performance over time to examine the sequential and reciprocal relationship among these aspects of organizations.

Second, this study explicitly examined manufacturing strategy, a functional strategy, as opposed to business- or corporation-level strategy. There are many appropriate levels of analysis for this type of research, but we chose to focus on manufacturing strategy because of its more direct relationship to what managers and first-line employees do daily. We thus viewed manufacturing strategy as most likely to reveal a relationship between HR systems and operational performance at the plant level. Nevertheless, future SHRM research should be directed at clarifying and mapping out the distinctive HR, strategy, and performance relationships at differing levels of analysis. Further, although manufacturing strategy has been discussed in the literature for years, it remains a somewhat elusive concept. Research is needed to more fully understand the specific dimensions of manufacturing strategy and how they work together.

A related point is that although we used multiple respondents to ensure agreement about strategy within each plant, there still remains an issue of whether managers presented us with intended or realized strategies (Mintzberg, 1978). We believe that managers in this study were realistic in their responses to our survey, but future research might corroborate our self-report measures with more objective indicators of strategic posture (cf. Glick, Huber, Miller, Doty, & Sutcliffe, 1990).

Third, our study focused on operational performance as opposed to financial performance or some other index of firm effectiveness. This focus was a conscious decision; however, we recommend that future research distill the performance consequences of HR activities at differing organizational levels. For example, Huselid's (1995) recent study of high performance work practices focuses on turnover and productivity as well as corporate financial performance. This is an excellent example of how HR systems establish a set of linked performance consequences within firms.

Fourth, the notions of internal and external fit suggest that there may be synergistic effects among and between both HR practices and strategy. In this study, we used bundles, or systems, of HR practices that were, strictly speaking, combined in an additive rather than multiplicative manner. In the future, more detailed work is needed on internal fit to ascertain whether HR systems are collections of distinct HR practices or whether there is a latent construct that subsumes the individual practices. And although we examined the interactions between HR systems and strategy, additional research that identifies configurations of HR practices and strategies is needed to reveal the potential synergistic effects among and between both HR practices and strategy (e.g., Doty, Glick, & Huber, 1993; Meyer, Tsui, & Hinings, 1993).

Finally, this study only looked at the moderating effects of manufacturing strategy on the HR-performance relationship. It is quite possible that other organizational characteristics, such as structure and technology, affect this relationship as well. The value of contingency research is that it allows researchers to look deeper into the HR-performance relationship. Accordingly, future contingency studies using other organizational characteristics as moderators are needed in order to gain further insights into the HR-performance relationship.

In today's manufacturing organizations, the performance management of human resources is receiving a good deal of emphasis. The intent of this study was to examine two alternative forms—*universal* and *contingency*—of the HR-performance relationship. Our findings show that HR systems can substantially influence performance when aligned with appropriate manufacturing strategies, thereby supporting a contingency view of HR. Establishing such a link is only one step of the many needed to gain a deeper understanding of how firms can manage human capital to improve competitiveness. So rather than dismissing one perspective or another, we would argue that more research is needed on how the two approaches may or may not converge. Certainly as manufacturers search for ways to enhance their productive potential for the future, this type of information would provide them with a richer understanding of how they can develop and manage human capital.

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IMPACT OF WORK TEAMS ON MANUFACTURING PERFORMANCE: A LONGITUDINAL FIELD STUDY

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We report the results of a longitudinal field study examining the impact of work teams on manufacturing performance. An electromechanical assembly plant was our research site from April 1992 through December 1993; work teams were formed on its four production lines in August 1992. Our results show that both quality and labor productivity improved over time after the formation of the teams. We offer qualitative insights into the functioning of these teams and their evolution over time, leading to workplace transformation.

The formation of work teams is a human resource management practice that is becoming commonplace in manufacturing plants (*Business Week,* 1994; Ichniowski & Shaw, 1995; *Manufacturing Studies Board,* 1986; *New York Times,* 1994; Osterman, 1994; Safizadeh, 1991). The popularity of work teams stems from the idea that by identifying and solving work-related problems, teams can contribute to improved performance. With an increasing emphasis on high-quality, fast product innovation and improved customer satisfaction, many companies now use team approaches to realize these goals in an environment characterized by functional and process interdependencies (Boyett & Conn, 1991). Work teams are considered to be "an integral tool aiding continuous improvement in work operations" (Cutcher-Gershenfeld and Associates, 1994: 42). Much of the evidence to date on the success of work teams, however, is in the form of anecdotes or descriptive case studies; stories of huge cost savings and quality improvements abound

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(Gupta & Ash, 1994; Hitchcock, 1993; Katzenbach & Smith, 1993; Schilder, 1992; Sheinkman, 1993; Tjosvold, 1991). In this article we empirically examine and document the impact of work teams on manufacturing performance over time in a natural setting.

THEORETICAL BACKGROUND

Our literature review focuses on studies that document (1) different types of work groups and teams in manufacturing environments and (2) teams' relationship to performance-related variables.

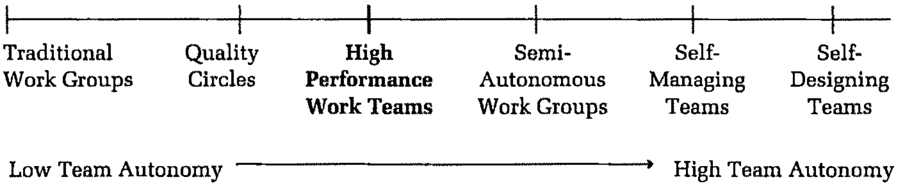
Types of Work Groups and Teams

A number of different types of work groups and teams are found in manufacturing environments today (cf. Goodman, Devadas, & Hughson, 1988; Hackman, 1987; Ledford, Lawler, & Mohrman, 1988). Teams can be classified on the team autonomy continuum depicted in Figure 1. Team types found on the far right have the most autonomy, and those on the far left have the least.

Traditional work groups. Workers perform core production activities, and other groups are responsible for support activities, such as receiving, quality control, and maintenance. Workers have no management responsibility or control. The first line manager controls planning, organizing, directing, staffing, and monitoring.

Quality circles. Membership is voluntary. Members are drawn from a particular work group or department. The group has the responsibility for making suggestions but does not have the authority to make decisions. The problem-solving domain is limited to quality- and productivity-related issues and cost reduction. Meetings are held on company time, usually weekly. A staff of specially trained facilitators helps team members with training and with group processes at meetings. No financial rewards are given for group suggestions. Typically, the group is not provided with systematic information on the firm's performance or strategic matters. The decision to install quality circles is made at the top of an organization, and the circles are created at the bottom of the organization. Although workers are organized to make suggestions within the defined domain, no changes are made in the day-to-day production hierarchy.

FIGURE 1
Team Autonomy Continuum



Semi-autonomous work groups. Workers manage and execute major production activities. Other groups perform support activities, such as quality control and maintenance, that are related to but outside the scope of major production activities.

Self-managing teams (or autonomous work groups). These are groups of individuals who can self-regulate work on their interdependent tasks. Group members have control over the management and execution of an entire set of tasks—from the acquisition of raw materials through the transformation process to shipping, including all support activities, such as quality control and maintenance, required to produce a definable product. The product could be a definable part of a production process rather than a completed product. The distinction between autonomous and semi-autonomous work groups is that the scope of the production tasks managed and executed by the autonomous type is narrower than that of the semi-autonomous type.

Self-designing teams. These groups have all the characteristics of self-managing teams. In addition, they have control over the design of the teams themselves and decide such issues as what tasks should be done and who should belong to the teams.

The work teams we investigated in this study are between quality circles and semi-autonomous work groups on the team-autonomy continuum depicted in Figure 1. Unlike quality circles, these work teams have some decision-making authority, but not to the extent characteristic of semi-autonomous work groups. Team membership is mandated by the management of the plant studied here and is not voluntary. Compared to quality circles, these teams have an expanded problem-solving domain, and they are provided with information on the plant's budget and competitors' products. Each team is composed of workers from the same production line. Hereafter, we shall refer to these teams as high performance work teams (HPWTs).

Work Teams and Manufacturing Performance

A common approach to measuring the impact of groups is to evaluate their effectiveness. Group effectiveness is defined as performance and employee satisfaction (Gladstein, 1984). More specifically, according to Hackman (1991), group effectiveness is the degree to which (1) a group's output meets requirements in terms of quantity, quality, and timeliness, (2) the group experience improves its members' ability to work as a group in the future, and (3) the group experience contributes to individual satisfaction. Our focus in this study was on the performance dimension.

In the quality management literature, experts advocate the use of teams as a means of improving quality. For example, Juran and Gryna (1980) suggested the use of "breakthrough" teams, and Deming (1986) emphasized the importance of worker input and management-worker cooperation for improving quality. It is also evident from our literature review that some theoreticians have tried to explain why participation in work teams is associated with performance improvement. For example, Mohrman and Novelli

(1985) discussed two models that relate participation in quality circles to improved productivity. The first model predicts that participation in quality circles leads to idea generation, which leads to idea implementation, which in turn leads to improved productivity. It is the implementation of the ideas themselves and the degree to which these ideas relate to productivity that contribute to productivity improvement. In the second model, participation in quality circles leads to favorable individual outcomes that improve job satisfaction, motivation, and task performance, leading to productivity improvement. This model incorporates many of the elements of the job characteristics model (Hackman & Oldham, 1980).

Several empirical studies in this domain focus on the effects of work teams on workers' attitudes and have some additional qualitative discussion on performance (see, for example, Wall, Kemp, Jackson, and Clegg [1986] and Ledford et al. [1988]). Some other studies have used cross-sectional research designs to examine the effects of quality circles on performance outcomes and to contrast the performance outcomes of participants and nonparticipants in quality circles (cf. Corbett & Harrison, 1992; Magjuka, 1991; Marks, Mirviss, Hackett, & Grady, 1986). Katz, Kochan, and Keefe (1987) surveyed plants of a major U.S. automobile manufacturer in 1979 and 1986 and found that work teams had a negative impact on plant productivity. Explaining their results, Katz and colleagues noted that "the negative impact of work teams on plant productivity in the company . . . resulted from problems associated with introducing the system . . . teams may yet help to improve productivity" (1987: 709). Griffin (1988) used a longitudinal and experimental research design to examine the impact of quality circles in an industrial setting and found positive impacts on perceptual measures of four individual-level dependent variables: job satisfaction, organizational commitment, performance, and intention to quit. Reviewing the empirical literature from economics, industrial relations, and organizational behavior on the effects of participation on performance, Levine and Tyson concluded that participation is more likely to have a positive impact on performance "when it involves decisions that extend to the shopfloor and when it involves *substantive* rather than consultative arrangements" (1990: 204).[1] Two more studies, Ichniowski, Shaw, and Prennushi (1994) and MacDuffie (1995), document the positive impact of a bundle of innovative human resource management practices on manufacturing performance. In both studies, work teams figured prominently in the bundle of innovative human resource management practices that positively impacted manufacturing performance. According to Osterman (1994), more than half of all U.S. firms are now exploring some form of team-based work system. In fact, teams have now become a topic of research investigation in their own right. For example, Cutcher-Gershenfeld and associates have been engaged in field research to derive insights into "the general nature of team-based work systems" (1994: 43). Consistent with such research efforts, our study examines the performance implications of a team-based work system over time in a manufacturing plant. In addition, the study provides qualitative insights into the transformation of a workplace with the formation of work teams.

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[1] According to Levine and Tyson, "*substantive participation* in work and workplace decisions includes formal, direct participation schemes, such as work teams," whereas "*consultative participation* allows employees to give their opinions, but final decisions are still made by management . . . [Q]uality control circles are the most common form of consultative participation" (1990: 189). The difference between these two forms of participation "is not in the content of the decisions, but in the degree of worker influence" (1990: 190).

RESEARCH SETTING

Our research site is a unionized plant operated by a division of a *Fortune* 500 firm. The plant has dedicated direct and indirect personnel, separate accountability, and separate record keeping. We conducted this study over a 21-month period, from April 1992 to December 1993. In August 1992, a separate HPWT was formed on each of the four production lines of the plant.

The family of products manufactured in this electro-mechanical assembly plant consists of a series of small motors used in industrial and residential applications. This family of motors has been designed using a modular strategy for increased manufacturing flexibility. All motors are built with component parts that have the same size and shape, but alternative combinations of the components result in numerous models. Consistent with this strategy, the manufacturing process used in the plant is a proven flexible automation technology. Although the extent of automation varies across the four production lines, the type of automation is the same—"pick and place" robots are interconnected by automated conveyor systems. A simultaneous engineering approach is used to coordinate product and process designs. Commercial production of the family of motors began in September 1990.[2] By the last quarter of 1991, the production on all four production lines of the plant was fully ramped up. Throughout our study period, the production of the family of motors continued at the fully ramped-up levels.

The Facility Layout and Work Organization

The plant is organized into three subassembly lines and one final assembly line and operates in a just-in-time (JIT) production environment. The three subassembly lines correspond to the three basic components of motors: submotor, gear train, and printed circuit board. On the final assembly line, these components are assembled into a motor. At the end of each of the four lines there is a quality inspection point where the products are functionally tested. The characteristics of products, capital and labor intensity, and labor skills vary across the four lines.

Submotor line. On this line, the product diversity is low since all submotors are identical except for the presence or absence of a mechanical spring-return device. The more complex process steps are done at the highly automated upstream end of the submotor line that operates with very little human intervention. However, a number of workers are needed to manually complete the product. The number of production workers in the HPWT on the submotor line varied between 7 and 11 during the study period.

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[2] Detailed production data for the period prior to April 1992 are not available.

Gear train line. This line consists of two areas: machining and assembly. Some of the parts used in the gear train are machined on the line. Unlike elsewhere in the plant, workers in the machining area of the gear train line are trained machinists. The assembly area is highly automated, and there are very few production workers in this area. As a group, they have more seniority than workers on the other production lines. They tend to be a very cohesive group, and there is little turnover. The number of production workers in the HPWT on the gear train line varied between 4 and 6 during the study period.

Printed circuit board line. This is the most capital intensive line in the plant. Ideally, the printed circuit boards should not be touched by the workers after their assembly begins and until their assembly is complete. The workers on this line are primarily involved in inspecting the completed boards. The number of production workers in the HPWT on the printed circuit board line varied between 4 and 6 during the study period.

Final assembly line. This is the most labor-intensive line in the plant. Product diversity on this line is high, because the end product is assembled using alternative combinations of the more standard inputs from the three subassembly lines. Experienced workers handle assembly of the printed circuit board to the gear train because it is a delicate job. Also, many of the production workers are involved in final functional testing, a job that requires trouble-shooting skills. The number of production workers in the HPWT on the final assembly line varied between 14 and 18 during the study period.

The specific types of manual jobs performed on the four lines include wiring, subassembly, circuit testing, insertion, drop-in, operational checks, component preparation, and functional testing. Even though these jobs required different skills, they can be learned quickly without any kind of special training. Job rotation was not practiced either within or across the teams on the four production lines during the study period.

Each of the four HPWTs consists of production workers from the line as well as the production engineer assigned to the line, the production planner, and the plant manager. All four teams are assigned to a common facilitator, an individual who was brought in from the division's training department to organize and train the HPWTs. In team meetings, the role of the facilitator is that of a resource person and not a team member. The leader of the team is chosen from among the production workers.

All production workers in the HPWTs on the four lines are members of the same union. They are paid on an hourly wage rate basis. Neither company policies guiding wage rates or medical and retirement benefits changed during the study period. The contractual agreement between the union and the division did not contain any clause on employment security for production workers. The production workers in the four HPWTs were long-time employees with an average tenure of 18 years and an average age of 42 years. Variations observed here in the number of production workers in an HPWT are the result of individuals being laid off, retiring, or leaving for jobs with higher wage rates elsewhere in the division, and the vacancies not being filled immediately. There was no indication of any production worker leaving the plant owing to the introduction of work teams. During our study period, vacancies on the production lines were filled with either workers from other plants of the division or from the pool of previously laid-off workers.

The Evolution and Functioning of HPWTs

We developed insights into the evolution and functioning of work teams by collecting qualitative information for periods both before and after the formation of the high performance work teams, with a particular emphasis on the form of participative decision making. This included a detailed examination of the HPWTs' meeting logs and training documents and interviews and discussion with the team facilitator, team leaders, production engineers, plant manager, divisional labor relations manager, and the divisional director of manufacturing operations. We used the insights gained to specify models for empirically examining the impact of HPWTs on manufacturing performance.

Our research site was the first plant in the division to be selected for work team implementation. The primary reason for this choice was the enthusiastic response of the plant manager. Other plant managers in the division had initially expressed concerns about the feasibility and effectiveness of work teams in a unionized environment. According to the divisional director of manufacturing operations,

> [the plant manager] firmly believed that work teams and turning over a portion of decision making to the work teams and running the factory that way was the wave of the future.

From management's standpoint, the primary objective for forming HPWTs on the four production lines was to institutionalize worker participation. The team facilitator observed:

> one of the reasons we [the management] wanted the teaming was that we knew that if we went to the production workers they would give us some ideas about what we could do better to get our costs down and be more competitive.

The initial months following the introduction of work teams were spent in establishing trust between production workers and "management," which included all nonunion personnel. The facilitator believed that developing trust was important in overcoming the production workers' resistance to HPWT formation. Given the numerous instances in the past of programs being introduced and then abandoned, production workers were skeptical of management's commitment to team implementation. Further, being unionized, the plant did not have a history of cooperation between workers and management. Speaking for her co-workers, a team leader stated that she

> was surprised that it [HPWTs] lasted the first year.

The facilitator played an important role in establishing trust between production workers and management by demonstrating that management was willing to implement the workers' ideas. She recalled the following incident in the early stages of team formation:

> They [the production workers] tested me. [They said] "Well, if we are going to be work teams, then we want to get a new light on our bench." So, I'd go to the plant manager and give them a new light. . . . Now they'd say "Oh, the plant manager is really going to let us have this stuff."

Trust between the workers and management improved over time on all four teams. According to a team leader,

> Some of the people [the skeptics] out there, they've changed their mind now. [They used to say] "It doesn't make any difference what I say, because they don't listen anyway." They have found that they do. Management does listen to what's said.

Another notable issue soon after the formation of HPWTs was conflict within the teams. The facilitator cited the submotor line, in particular, as one that had a high level of internal conflict among the team members after the formation of the HPWT. This conflict persisted throughout the study period. On the other hand, consistent with the preteam character of the working group on the gear train line, relations among the team members were especially harmonious. The conflict levels on the printed circuit board and final assembly teams were between these two extremes, and the facilitator did not identify any major issues related to conflict resolution among the team members. For the teams on the board and final assembly lines, the facilitator could not identify any major issues related to internal conflict between the team members.

After the initial months of trust building and conflict resolution, the facilitator made a concerted effort to get the HPWTs focused on solving problems. For the six months from January through June 1993, all members of the four HPWTs went through a "10-module toolkit training" intended to facilitate their ability to work as a team. The topics of the ten modules are: (1) vision of a competitive factory with a future, and values related to people, customer, quality, safety, and competitiveness, (2) mutual goals, interdependent working relationships, and commitment to the group effort, (3) organizing effective meetings, (4) defining team goals and purpose, (5) understanding self and others, (6) reviewing team processes, (7) listening effectively, (8) providing constructive feedback, (9) benefits of having conflicts and techniques for conflict resolution, and (10) the process of problem solving. This training program was mandatory, and any production worker who joined the plant had to go through it. Evaluating the impact of the training, the facilitator said

> Actually, once you did some coaching and some training in the modules of the toolkit, they could relate to that . . . it [training] worked.

Examination of the meeting logs of the HPWTs on each of the four production lines suggested that after June 1993, the month in which the HPWT members on the four production lines completed their 10-module toolkit training, the orientation of the actionable entries in the log book began to shift from individual to group-level issues, such as revising the parts ordering system and increasing training on a specialized machine to reduce defects. Although some of the issues were still assigned by the team to the production engineer, others were increasingly being assigned to individual workers or the team as a whole. This was in contrast to the orientation of the actionable entries in the log book in the months immediately following the introduction of work teams, when they were mostly individual-oriented issues, such as the need for new chairs and tools for a particular workstation. Further, the responsibility of resolving these issues was usually given to a production engineer or the plant manager. Around mid-1993, the plant manager also authorized the HPWTs to implement suggestions for improvement costing less than $200—an amount that covered a significant number of ideas for operational improvements. Expenditures above $200 were handled by the plant's usual operating procedures.

Our discussion of the evolution of the HPWTs indicates that the form of participation in the teams was becoming increasingly substantive. We will now describe the functioning of teams to get further insights into mechanisms that support substantive participation.

The HPWTs meet separately once a week for about an hour in a conference room. Quality, the past week's accomplishments, customer delivery, and variances from budgets are the issues that are always discussed in the team meetings. The meetings also serve as a forum for sharing information on topics such as the division's budget, the financial performance of the plant compared to that of other plants in the division, competitors' products, changes in the customer base, and problems with the products in the field. Prior to the implementation of teams, such issues were seldom discussed with the production workers. On occasion customers and vendors attend the team meetings. Coordination and communication across the HPWTs is maintained by allowing one or more team members from another HPWT to attend the team meetings whenever it is required.

In all team meetings, ideas or problems that require action are recorded in a meeting log (known as the action log); the log notes who submitted the item, who is responsible for addressing it, and when it should be completed. In subsequent meetings the status of the item or its completion date is entered. At the end of each month the facilitator completes a team progress report that addresses progress on the seven primary team responsibilities: quality, customer satisfaction, training, action log and team meetings, cost awareness and management, safety and ergonomics, and housekeeping. HPWTs are encouraged to aggressively work toward resolution of action log items and are evaluated on their progress in resolving these items.

The plant manager used the following example to illustrate how ideas for operational improvement are generated during team meetings:

> We have got that op check fixture that was built upstairs by the auto lab. This is a pretty expensive machine. Initially it was going to be a six-headed machine, and still is . . . three heads were going to be here [on one side], and three heads were going to be here [on the other side]. . . . As we met with the team, we decided to come up with a half round machine. Now the six heads are all here. . . . So that addressed some ergonomic issues.

According to a team leader,

> We [production workers] get out of there [team meetings] feeling like we've accomplished something. I do. When I go to the team meetings, I feel that a lot of things have been accomplished, things that I couldn't have done on the floor without getting them [the team members] all together.

The above insights into the evolution and functioning of HPWTs suggest that group effectiveness, as defined earlier, continued to improve over the 21-month study period. Since the HPWTs were authorized to implement many ideas independent of management, the production workers' participation in decision making was largely substantive rather than consultative. As noted earlier, substantive participation involves formal and direct participation in work and workplace decisions and is likely to have a positive impact on performance. The trajectory of the HPWTs' evolution and their increasing effectiveness suggest that their performance impact should be modeled as a time-trend rather than as a one-time intervention. In the next section, we analyze panel data from the four production lines to see if there is quantitative evidence of the effectiveness of work teams measured in terms of improvement in manufacturing performance.

METHODS

Our study period, from April 1992 through December 1993, provides a window into a naturally occurring experiment of conversion to HPWTs. This was a period occurring well after the start-up of the plant. As noted earlier, production volume for all four lines in the plant was fully ramped up by the end of 1991. Besides the introduction of HPWTs in August 1992, no other intervention could potentially confound the impact of work teams on manufacturing performance. For example, no new product families or operational practices were introduced, nor were there any changes in process technologies or facility layout. Human resource management policies such as those related to compensation, recruitment and selection, employment security, job assignment, skills training, and communication (Ichniowski et al., 1994; MacDuffie, 1995) were the same across the four production lines and did not change during the study period.

Dependent Variables

We employed a longitudinal research design to examine the impact of HPWTs on manufacturing performance. The dependent variables for our study were quality and labor productivity. From a theoretical standpoint, these measures correspond to the performance dimension of group effectiveness (Hackman, 1991) discussed earlier. These measures are also consistent with MacDuffie's (1995) study of automobile assembly plants, which examines the impact of clusters of innovative human resource management practices on manufacturing performance.

Quality (manufacturing defect rate). We measured quality as the percentage of total units produced that were defective. Since data on quality were available by the week, the study period for all quality-related analyses comprises 84 weeks.[3]

Labor productivity. Since HPWTs were not formed until the family of motors in the plant were more than 18 months into volume production, changes in process equipment, design, and raw materials had stabilized. The productivity issues that the HPWTs tend to focus on are the ones that allowed them to produce more units per worker. Thus, we focus on labor productivity, measured as a ratio of the number of units produced to total production hours. Since data on productivity are available by month, the study period for all productivity-related analyses comprises 21 months.

Independent Variable

Postteam time trend (abbreviated in equations as *TEAMTR*) represents the impact of HPWTs over time. It is measured as the number of weeks (for quality equations) or months (for labor productivity equations) since the formation of HPWTs and assumes the value 0 for the weeks and months before the formation of HPWTs.

Control Variables

To isolate the impact of HPWTs, we controlled for a number of other variables that are considered drivers of manufacturing performance. Following Hayes and Clark (1985), we identified the following four relevant groups of managerial policies: equipment policies, work-in-process (WIP) inventory policies, workforce policies, and policies affecting confusion in the factory. We did not consider equipment policies to be an important category of variables affecting performance since most of the plant's equipment and relevant policies (e.g., maintenance policies) were in place before April 1992, the beginning of the study period, and did not change appreciably during the period. Additionally, we did not include work-in-process inventory in the analysis because the plant has had a just-in-time (JIT) production environment since its inception and operates with minimal inventory. Our examination of the WIP data, available only at the plant level, suggested that the work-in-process level had been fairly constant throughout the study period. Defective units on all four lines were reworked and repaired on the same day they were detected.

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[3] Out of the 91 weeks in our study period, there are 7 weeks for which one or more observations were missing.

Following Hayes and Clark (1985), we identified variables that are representative of policies related to workforce and confusion in a plant. We operationally defined the variables related to workforce policies as follows: *Overtime* was measured as overtime hours per worker for each production line in a given period. *Headcount additions* was the number of workers who joined expressed as a percentage of the total number of workers on a production line in a given period. *Headcount deletions* was the number of workers who left expressed as a percentage of the total number of workers on a production line in a given period.

We operationally defined the variables related to the policies affecting confusion in the plant as follows: *Product diversity* was measured as a Herfindahl index (Gollop & Monahan, 1991) to reflect product heterogeneity on a production line in a given period. The Herfindahl index is of the form $1 - \Sigma s^2_j$, where s_j is the share of the jth distinct product in the total production. *Product complexity* was measured as the volume-weighted average of device complexity based on manufacturing difficulty (e.g., Cooper, Sinha, & Sullivan, 1992; Ittner, 1992) on each production line for a given period.[4] The complexity index is of the form $c_j x_j / \Sigma x_j$, where c_j is the complexity value for product j and x_j is the volume of product j. *Capacity utilization* was the percent deviation from the planned production rate for a production line in a given period, which reflects approximate capacity for that period. We used two variables to distinguish between positive and negative deviations. Capacity overutilization (*VOLUP* in equations) was the percent positive deviation; it assumes the value 0 whenever the deviations are negative. Capacity underutilization (*VOLDN*) was the percent negative deviation; it assumes the value 0 whenever the deviations are positive. *Engineering change orders* was the total number of such orders issued on a production line in a given period that were not related to quality improvement. *Adhesive experiment period on the gear train line* derived from our discussion with the plant manager, who indicated that engineers experimented with alternative adhesives on the gear train line during the months April through September 1993. Such experimentation is considered to be outside the normal production process and is known to cause unusually high defect rates on a line. To indicate this period in the relevant model specifications, we used a dummy variable (*GTADH*) that assumes the value 1 for the adhesive experiment periods and 0 otherwise.

We also included a variable called *preteam time trend* (*PRTMTR*) to verify that there were no performance time trends, such as the learning curve effect, prior to the formation of HPWTs. It was measured as the number of weeks (for quality equations) or months (for productivity equations) since the beginning of the study and before the formation of HPWTs and as 0 after the formation of HPWTs.

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[4] From the engineering department, we obtained ratings on the critical features of the products on the four production lines—namely, (1) control mechanism, (2) mechanical characteristics, and (3) electrical characteristics—in terms of their manufacturing difficulty. Each of these features was assigned a numerical value (the higher the number, the more complex it was). These features are coded in the model numbers assigned to the products. With information on the product model numbers and production volume for a given period, we calculated volume-weighted average complexity for the period.

Model Specifications

To examine the impact of HPWTs, we employed two statistical models—a fixed-effects model and a seemingly unrelated regressions (SUR) model—for each of the two measures of manufacturing performance, quality and labor productivity.

Fixed-effects model. This method involved pooling the observations from all four production lines of the plant. The formulation of the fixed-effects model was based on the assumption that differences across production lines can be captured by differences in the intercept term (Greene, 1993). We pooled the data from the production lines and added a dummy variable indicating each of three production lines to the model to estimate the differences in the intercept term from the fourth production line.[5] The fixed-effects models were formulated as follows:

$$\begin{aligned} DEF_{ti} = {} & \lambda_0 + \lambda_1 PRTMTR_{ti} + \lambda_2 OT_{ti} + \lambda_3 ADDS_{ti} + \lambda_4 DELS_{ti} + \lambda_5 DIV_{ti} \\ & + \lambda_6 COMP_{ti} + \lambda_7 VOLUP_{ti} + \lambda_8 VOLDN_{ti} + \lambda_9 ECO_{ti} + \lambda_{10} TEAMTR_{ti} \\ & + \lambda_{11} GTADH_{ti} + \lambda_{12} SUBM_{ti} + \lambda_{13} GEAR_{ti} + \lambda_{14} BOARD_{ti} + \varphi_{ti}, \end{aligned} \tag{1}$$

and

$$\begin{aligned} PROD_{ti} = {} & \delta_0 + \delta_1 PRTMTR_{ti} + \delta_2 OT_{ti} + \delta_3 ADDS_{ti} + \delta_4 DELS_{ti} + \delta_5 DIV_{ti} \\ & + \delta_6 COMP_{ti} + \delta_7 VOLUP_{ti} + \delta_8 VOLDN_{ti} + \delta_9 ECO_{ti} + \delta_{10} TEAMTR_{ti} \\ & + \delta_{11} GTADH_{ti} + \delta_{12} SUBM_{ti} + \delta_{13} GEAR_{ti} + \delta_{14} BOARD_{ti} + \kappa_{ti}, \end{aligned} \tag{2}$$

where the variables in period t for production line i are defined as

DEF_{ti} = quality (manufacturing defect rate),
$PROD_{ti}$ = labor productivity,
$PRTMTR_{ti}$ = preteam time trend,
OT_{ti} = overtime,
$ADDS_{ti}$ = addition of production workers,
$DELS_{ti}$ = deletion of production workers,
DIV_{ti} = product diversity,
$COMP_{ti}$ = product complexity,
$VOLUP_{ti}$ = capacity overutilization,
$VOLDN_{ti}$ = capacity underutilization,
ECO_{ti} = engineering change orders,
$TEAMTR_{ti}$ = postteam time trend,

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[5] Specifically, in models 1 and 2 we included dummy variables for the submotor, gear train, and printed circuit board lines. The estimated coefficients of these dummy variables represent the average differences in the performance measure from the final assembly line.

$GTADH_{ti}$ = a dummy variable coded 1 for observations from the adhesive experiment period on the gear train line, 0 otherwise,
$SUBM_{ti}$ = a dummy variable coded 1 for observations from the submotor line, 0 otherwise,
$GEAR_{ti}$ = a dummy variable coded 1 for observations from the gear train line, 0 otherwise,
$BOARD_{ti}$ = a dummy variable coded 1 for observations from the printed circuit board line, 0 otherwise,

and

$\varphi_{ti}, \kappa_{ti}$ = random residual terms.

The time period t differs depending on whether a regression model involves defect rate or labor productivity as the dependent variable. Since the manufacturing defect rate data were available weekly, time period t is a week for the regressions with defect rate as the dependent variable. However, the production hours data used to estimate labor productivity were available only on a monthly basis. Hence, t is a month for regressions with labor productivity as the dependent variable.

Seemingly unrelated regressions (SUR) model. This method involves estimating separate equations for each production line while recognizing relationships across the production lines. Unlike the fixed-effects model, the SUR model allows the coefficients of the independent and control variables to differ by line (Greene, 1993). Although this procedure provides a less powerful statistical test than the fixed-effects model, it provides a check of the robustness of the more restrictive fixed-effects model. For each production line (i.e., submotor, gear train, board, and final assembly), we formulated the models as follows:

$$\begin{aligned} DEF_{ti} = {} & \alpha_{0i} + \alpha_{1i}PRTMTR_{ti} + \alpha_{2i}OT_{ti} + \alpha_{3i}ADDS_{ti} + \alpha_{4i}DELS_{ti} \\ & + \alpha_{5i}DIV_{ti} + \alpha_{6i}COMP_{ti} + \alpha_{7i}VOLUP_{ti} + \alpha_{8i}VOLDN_{ti} + \alpha_{9i}ECO_{ti} \\ & + \alpha_{10i}TEAMTR_{ti} + \alpha_{11G}GTADH_{tG} + \psi_{ti}, \end{aligned} \tag{3}$$

and

$$\begin{aligned} PROD_{ti} = {} & \beta_{0i} + \beta_{1i}PRTMTR_{ti} + \beta_{2i}OT_{ti} + \beta_{3i}ADDS_{ti} + \beta_{4i}DELS_{ti} \\ & + \beta_{5i}DIV_{ti} + \beta_{6i}COMP_{ti} + \beta_{7i}VOLUP_{ti} + \beta_{8i}VOLDN_{ti} + \beta_{9i}ECO_{ti} \\ & + \beta_{10i}TEAMTR_{ti} + \beta_{11G}GTADH_{tG} + \xi_{ti}, \end{aligned} \tag{4}$$

where each system consists of four equations—one each for i = S (submotor line), G (gear train line), B (printed circuit board line), and F (final assembly line). Except for the random residual terms, ψ_{ti} and ξ_{ti}, the variable definitions in Equations 3 and 4 are identical to those presented after the fixed-effects models, Equations 1 and 2. The subscript i on the coefficients of the independent and control variables indicates that, unlike in the fixed-effects model, they are specific to production line i. The variable for the adhesive experimentation period (*GTADH*) is included only in the equations for the gear train line to represent April through September 1993, when the engineers experimented with alternative adhesives.

We considered the inclusion of lagged variables in the model formulation to be unnecessary because of the short average production cycle time in the plant (less than a day). Hence, most variables have either no lagged effect or a one-day lagged effect. However, since the length of the time period *t* was one week in the defect rate equations and one month in the labor productivity equations, the effects of a one-day lag were likely to be negligible.

Data Collection

The data for the study were collected from the plant's production, quality, personnel, and accounting records. The availability from April 1992 through December 1993 of a consistent set of data on the pertinent variables defined the period over which the study was conducted. As noted, data on all variables except actual production hours were available on a weekly basis, with production hours data available only monthly. Hence, as also noted above, the analyses involving labor productivity were conducted at a monthly level and those involving manufacturing defect rate were conducted at a weekly level. For all the variables except those measuring the positive and negative deviations from the planned production rates, data were available by production line. The significance of deviations from planned production rate is at the plant level, but the effect at the individual production line is similar because production volume is coordinated among the lines.

Diagnostics

We examined the data for collinearity and the residuals for outliers and violations of ordinary-least-squares (OLS) assumptions. With time series data and interconnected production lines, it is likely that the presence of serial and contemporaneous correlation and heteroscedasticity could result in inefficient estimates of the parameters, or biased and inconsistent estimates of their standard errors, or both.

Time series data are likely to require adjustments for serial correlation in the residuals. Where there was evidence of first-order autocorrelation, the data were transformed with the Prais-Winsten procedure (Park & Mitchell, 1980). Subsequent estimation with the transformed data showed that autocorrelation was insignificant. Also, after we had transformed the data for serial correlation, collinearity diagnostics (Belsley, Kuh, & Welsch, 1980) indicated that there were no collinearity problems.

Commonalties among the four production lines were likely to result in contemporaneous correlation between the residuals of the four separate regression equations. If ignored, the estimated coefficients of the separate regressions would be inefficient, with potentially biased standard errors. Thus, as noted earlier, we estimated the system of equations as a set of seemingly unrelated regressions (SUR). The correlations among residuals across production lines were as high as 0.37 in the defect rate equations. The correlations were as high as 0.55 in the labor productivity equations. However, in both cases conclusions drawn from the separate OLS and SUR models were very similar.

Heteroscedasticity and nonlinearity of the residuals were problems for both models. Transforming the dependent variables by taking natural logarithms (*DEF* and *PROD* became *LNDEF* and *LNPROD*, respectively) based on a Box-Cox analysis corrected these problems. White's (1980) test revealed no significant heteroscedasticity after the transformation.

Finally, on the basis of influence diagnostics (Belsley et al., 1980) observations corresponding to suspected outliers in the residuals were deleted, and the regression equations were then reestimated. Since the conclusions were essentially the same as the results using the full data set, we report the results based on the full data set.

RESULTS

Impact of HPWTs on Quality

Table 1 contains descriptive statistics and the correlation matrix for the weekly data set used for estimating the regression models related to quality (manufacturing defect rate). The correlation between the logarithm of manufacturing defect rate and the postteam time trend is negative and statistically significant at the 1 percent level. Table 2 summarizes the regression results for the fixed-effects model. Although the coefficient estimate for the preteam time trend is not significant, the coefficient estimate for the postteam team time trend is negative and significant at the 1 percent level. These results indicate that there is no time trend in the defect rate prior to the formation of the high performance work teams. However, in the weeks following the formation of the HPWTs there is a significant reduction in the defect rate. The coefficient estimate of -0.011 for the postteam time trend translates into a 38 percent reduction in the defect rate from the beginning to the end of the postteam period in our study. The coefficient estimate for the dummy variable for the period during which experiments were conducted with alternative adhesives on the gear train line is positive and statistically significant, suggesting that there was a significant increase in defect rate on the gear train line during the adhesive experiment period, April–September 1993.

Table 3 summarizes the results of the SUR estimation procedure. In the equations for the four production lines, none of the coefficient estimates for the preteam time trend is significant. In all four equations, the coefficients for the postteam time trend are negative; for the gear train and the final assembly lines they are also significant at the 1 percent level. These results are in agreement with the fixed-effects model results. Also, as in the case of fixed-effects model, the coefficient estimate for the dummy variable for the adhesive experiment period on the gear train line is positive and significant.

Impact of HPWTs on Labor Productivity

Table 1 also contains descriptive statistics and the correlation matrix for the monthly data set used for estimating the regression models related to labor productivity. The correlation between the logarithm of labor productivity and the postteam trend is positive and significant at the 5 percent

TABLE 1
Descriptive Statistics and Correlations[a]

	Monthly Data		Weekly Data																	
Variable	Mean	s.d.	Mean	s.d.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Log of quality[b]			−3.18	0.71			.16**	−.03	−.10	−.15**	−.08	.01	−.04	.14**	.14**	−.29**	−.35**	−.11*	.64**	.17**
2. Log of labor productivity	1.80	0.65																		
3. Preteam time trend	0.71	1.46	2.78	5.84		−.13		−.15**	−.04	.09	−.37**	−.10	−.05	.15**	−.06	−.55**	.00	.00	.00	−.13*
4. Overtime	27.40	8.00	6.27	1.72		.05	−.15		.35**	.07	−.07	.06	.12*	−.38**	−.06	.38**	.00	.00	.00	.16**
5. Headcount additions	0.02	0.05	0.01	0.01		−.24*	−.02	.34**		.19**	.01	.02	−.07	−.07	−.06	.07	.17**	−.18**	−.17**	−.12*
6. Headcount deletions	0.03	0.04	0.01	0.01		−.16	.09	.05	.16		−.07	−.12*	−.04	.13*	−.09	−.09	.21**	.04	−.25**	−.02
7. Product diversity	2.05	0.70	2.08	0.75		.11	−.44*	−.07	.06	−.18		.02	−.02	.11*	−.01	.27**	.00	.00	.00	.00
8. Product complexity	1.00	0.05	1.00	0.04		.06	−.03	.11	.11	−.29**	.39**		.07	−.05	−.01	.14**	.00	.00	.00	.00
9. Capacity overutilization	0.00	0.00	0.02	0.04		.04	−.19	.57**	−.01	.01	.11	.07		−.36**	.07	.09	.00	.00	.00	.05
10. Capacity underutilization	0.10	0.09	0.11	0.11		−.13	.20	−.50**	−.07	.17	−.04	−.32**	−.42**		−.01	−.42**	.00	.00	.00	−.07
11. Engineering change orders	2.14	2.43	0.49	0.56		−.46**	−.07	−.06	−.05	−.10	−.06	.04	.01	−.04		−.14**	−.39**	−.31**	.11*	−.13*
12. Postteam time trend	6.48	5.45	26.50	23.00		.25*	−.59**	.30**	.05	−.10	.42**	.29**	.35**	−.58**	−.15		.00	.00	.00	.22**
13. Submotor line dummy	0.25	0.44	0.25	0.43		−.15	.00	.00	.17	.21	.00	.00	.00	.00	−.40**	.00		−.33**	−.33**	−.16**
14. Gear train line dummy	0.25	0.44	0.25	0.43		.48**	.00	.00	−.17	.04	.00	−.00	.00	.00	−.31**	.00	−.33**		−.33**	.48**
15. Board line dummy	0.25	0.44	0.25	0.43		.47**	.00	.00	−.17	−.25*	.00	−.00	.00	.00	.11	.00	−.33**	−.33**		−.16**
16. Adhesive experiment dummy	0.07	0.26	0.07	0.26		.32**	−.14	.14	−.12	−.02	.02	.05	.07	−.12	−.13	.21	−.16	.48**	−.16	

[a] Correlations above the diagonal correspond to weekly data for manufacturing defect rate regressions; correlations below the diagonal correspond to monthly data for labor productivity regression. For monthly data, $N = 84$; for weekly data, $N = 355$.

[b] Manufacturing defect rate.

* $p < .05$

** $p < .01$

TABLE 2
Results of Estimation of the Fixed-Effects Model[a]

Variable	Coefficient Estimate	Standard Error
Intercept (λ_0)	−2.023**	0.297
Preteam time trend (λ_1)	0.004	0.007
Overtime (λ_2)	−0.004	0.010
Headcount additions (λ_3)	0.411	2.972
Headcount deletions (λ_4)	2.829	3.090
Product diversity (λ_5)	0.173	0.195
Product complexity (λ_6)	−0.144	0.426
Capacity overutilization (λ_7)	0.007	0.511
Capacity underutilization (λ_8)	−0.061	0.230
Engineering change orders (λ_9)	−0.045	0.073
Postteam time trend (λ_{10})	−0.011**	0.002
Adhesive experiment dummy (λ_{11})	1.034**	0.143
Submotor line dummy (λ_{12})	−0.218	0.114
Gear train line dummy (λ_{13})	−0.252*	0.123
Board line dummy (λ_{14})	1.010**	0.100
R^2	0.485	
Adjusted R^2	0.462	
F	21.071**	

[a] The dependent variable is the logarithm of quality (manufacturing defect rate); $N = 328$.
* $p < .05$
** $p < .01$

level. Table 4 summarizes the regression results for the fixed-effects model. The coefficient estimate for the preteam time trend is not significant, but the coefficient estimate for the postteam time trend is significant at the 5 percent level. As in the case of quality, these results indicate no time trend in labor productivity prior to the formation of HPWTs. However, there is a significant improvement in labor productivity in the months following the formation of HPWTs. The coefficient estimate of 0.023 for the postteam time trend translates into a 20 percent improvement in labor productivity from the beginning to the end of the postteam period in our study. The statistically significant control variables suggest that the departure of production workers and capacity overutilization have negative impacts.[6]

Table 5 summarizes the results of the seemingly unrelated regressions estimation procedure. Since each production line has only 21 observations,

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[6] In Table 1 three pairwise correlations are greater than .50 for the monthly data: (1) between overtime and capacity overutilization, $r = .57$; (2) between overtime and capacity underutilization, $r = -.50$; and (3) between capacity underutilization and postteam time trend, $r = -.58$. Although the collinearity diagnostics indicated that we had no predictor collinearity problem, we confirmed this by deleting overtime, capacity overutilization, and capacity underutilization one at a time from the base model. The three separate sensitivity analyses showed that the estimated coefficients of the remaining variables, most importantly the team variable, were stable.

TABLE 3
Results of Estimation of the Seemingly Unrelated Regressions Model[a]

Variable	Submotor Line	Gear Train Line	Board Line	Final Assembly Line
Intercept (α_{0i})	−1.725**	−4.947**	−0.603*	−3.063**
	(0.517)	(1.405)	(0.291)	(0.733)
Preteam time trend (α_{1i})	0.014	−0.004	0.020	−0.006
	(0.013)	(0.013)	(0.016)	(0.009)
Overtime (α_{2i})	−0.047	0.063	−0.085	0.031
	(0.034)	(0.045)	(0.047)	(0.025)
Headcount additions (α_{3i})	−0.618	22.900	8.366	1.440
	(4.010)	(11.599)	(11.650)	(3.901)
Headcount deletions (α_{4i})	1.499	−6.003	11.564	−3.043
	(4.441)	(7.066)	(13.180)	(5.619)
Product diversity (α_{5i})	−0.898	1.250	0.130	0.014
	(1.505)	(3.936)	(0.248)	(0.236)
Product complexity (α_{6i})	0.297	1.200	−0.284	0.629
	(1.305)	(4.768)	(0.598)	(0.948)
Capacity overutilization (α_{7i})	1.060	0.767	−1.470	−0.668
	(0.998)	(1.279)	(0.863)	(0.742)
Capacity underutilization (α_{8i})	0.526	−0.049	−1.239**	0.025
	(0.450)	(0.555)	(0.406)	(0.333)
Engineering change orders (α_{9i})	−0.049	−0.461	0.091	0.119
	(0.352)	(0.234)	(0.140)	(0.078)
Postteam time trend (α_{10i})	−0.005	−0.022**	−0.006	−0.011**
	(0.004)	(0.004)	(0.006)	(0.002)
Adhesive experiment dummy (α_{11i})		1.289**		
		(0.175)		
R^2	0.219	0.560	0.204	0.351
Adjusted R^2	0.109	0.491	0.092	0.260
F	1.990*	8.105**	1.824	3.841**
N	82	82	82	82

[a] The dependent variable is the logarithm of quality (manufacturing defect rate). Values in parentheses are standard errors.

* $p < .05$

** $p < .01$

and the regression has 10 variables (11 variables for the gear train line) plus an intercept term, the power of statistical tests is low. Hence, unlike the fixed-effects model, the SUR model does not permit us to draw sharp conclusions about the impact of HPWTs on labor productivity across the four production lines. In the equations for the four production lines, none of the coefficient estimates for the preteam time trend is significant. The coefficient estimates for the postteam time trend for the gear train and board lines are positive and significant at the 1 percent and 5 percent levels, respectively, which is consistent with the results of the fixed-effects model of labor productivity.

TABLE 4
Results of Estimation of the Fixed-Effects Model[a]

Variable	Coefficient Estimate	Standard Error
Intercept (δ_0)	0.392**	0.122
Preteam time trend (δ_1)	0.010	0.023
Overtime (δ_2)	0.006	0.003
Headcount additions (δ_3)	0.486	0.507
Headcount deletions (δ_4)	−1.211**	0.448
Product diversity (δ_5)	0.222	0.222
Product complexity (δ_6)	−0.394	0.356
Capacity overutilization (δ_7)	−20.211**	5.208
Capacity underutilization (δ_8)	0.118	0.267
Engineering change orders (δ_9)	−0.010	0.012
Postteam time trend (δ_{10})	0.023*	0.010
Adhesive experiment dummy (δ_{11})	0.109	0.131
Submotor line dummy (δ_{12})	0.705**	0.124
Gear train line dummy (δ_{13})	1.382**	0.130
Board line dummy (δ_{14})	1.391**	0.118
R^2	0.794	
Adjusted R^2	0.752	
F	18.973**	

[a] The dependent variable is the logarithm of labor productivity; $N = 84$.
* $p < .05$
** $p < .01$

Update on HPWTs

More than a year and a half after the end of our study period, we conducted follow-up meetings with plant personnel. We learned from these meetings that the teams were functioning effectively and continuing to contribute to manufacturing performance improvements for the four production lines at our research site. The divisional director of manufacturing operations and the plant manager believed that a key to sustaining the effectiveness of the teams was conducting their meetings regularly. According to the plant manager,

> the main part of being a member of a team is to make sure that they [meetings] are happening all the time, consistently. It's something that is just really easy to sweep under the carpet. And once you do that a couple of times, pretty soon you lose the focus of the teams, and you don't have them any more . . . your teams will fail if you don't make it a point that they happen consistently and regularly.

We also learned during these meetings that in early 1995 job rotation was introduced within each team on the four production lines for ergonomic reasons and that all team members were going through a training program in total quality management. These developments are consistent with find-

TABLE 5
Results of Estimation of the Seemingly Unrelated Regressions Model[a]

Variable	Submotor Line	Gear Train Line	Board Line	Final Assembly Line
Intercept (β_{0i})	1.447	4.816*	1.588	1.426*
	(0.776)	(1.831)	(1.223)	(0.559)
Preteam time trend (β_{1i})	−0.014	0.039	0.014	0.037
	(0.048)	(0.053)	(0.055)	(0.029)
Overtime (β_{2i})	0.007	−0.006	0.005	0.003
	(0.010)	(0.009)	(0.010)	(0.005)
Headcount additions (β_{3i})	1.018	2.141	−1.464	0.206
	(1.011)	(3.062)	(1.722)	(0.611)
Headcount deletions (β_{4i})	−0.210	−0.934	−3.102	−1.990*
	(1.083)	(1.530)	(1.904)	(0.849)
Product diversity (β_{5i})	−0.335	−1.547	0.038	0.418
	(2.439)	(8.390)	(0.463)	(0.358)
Product complexity (β_{6i})	−0.015	−1.223	0.157	−0.962
	(2.331)	(8.229)	(1.310)	(0.655)
Capacity overutilization (β_{7i})	−5.005	−11.652	−19.527	−11.594
	(18.060)	(20.914)	(15.609)	(9.057)
Capacity underutilization (β_{8i})	0.010	0.081	1.176	0.699
	(0.780)	(0.847)	(0.743)	(0.470)
Engineering change orders (β_{9i})	−0.004	0.052	0.002	−0.013
	(0.067)	(0.048)	(0.027)	(0.012)
Postteam time trend (β_{10i})	−0.001	0.060**	0.053*	0.014
	(0.016)	(0.016)	(0.018)	(0.009)
Adhesive experiment dummy (β_{11i})		0.069		
		(0.124)		
R^2	0.291	0.809	0.827	0.783
Adjusted R^2	−0.418	0.574	0.654	0.566
F	0.410	3.455*	4.776*	3.609*
N	21	21	21	21

[a] The dependent variable is the logarithm of labor productivity. Values in parentheses are standard errors.

* $p < .05$

** $p < .01$

ings of MacDuffie (1995), who observed a trend toward "bundling" innovative human resource practices in modern manufacturing plants.[7]

CONCLUSIONS

The purpose of this study was to empirically examine the impact of work teams on manufacturing performance. During the 21-month study period at our research site, there was a naturally occurring experiment of conversion to work teams. Using a longitudinal research design, and controlling for other variables that have the potential to affect manufacturing performance, we obtained results indicating that quality and labor productivity improved over time after the introduction of work teams. We supplemented these quantitative results with qualitative insights into the functioning of work teams and their evolution over time, leading to workplace transformation.

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[7] We thank an anonymous reviewer for this insight.

We infer from the results of the fixed-effects models that for the plant as a whole there was improvement in both quality and labor productivity after high performance work teams were formed. However, for the individual production lines, the results of the SUR models suggest improvement in both quality and labor productivity after the formation of the HPWT on the gear train line only. This may be explained by the fact that the gear train line team was considered to be the most cohesive group. In contrast, there was no improvement in either quality or labor productivity on the submotor line after the formation of its HPWT. An explanation for this result is that there was conflict among the members of the submotor team in the months following the formation of the HPWT and persisting throughout the study period. On the board and final assembly lines, the signs of the estimated coefficients for the postteam time trend for both the quality and productivity regressions were in the predicted directions, but not always significant. The team dynamics of the board and final assembly teams suggest that they fell between the two extremes represented by the gear train and submotor lines, consistent with the regression results.

A limitation of this study is the absence of data from a control plant similar in all respects to our experimental plant but without formal work teams. The lack of such data prevents us from making a definitive causal attribution. However, by controlling for other variables that are known to affect manufacturing performance, our results provide evidence of the positive impact of work teams on manufacturing performance. Another limitation of this study, and in all fairness, of any field study, is the issue of the generalizability of findings. In some sense, we have tried to overcome this limitation by analyzing a panel data set that included longitudinal data from four production lines varying in terms of capital and labor intensity, tasks, skill mix, and the number of production workers in the work teams. Despite these caveats, we believe that it is important to advance human resource management research by systematically documenting the performance impact of work teams in real-world organizational settings.

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PREDICTING THE PERFORMANCE OF INITIAL PUBLIC OFFERINGS: SHOULD HUMAN RESOURCE MANAGEMENT BE IN THE EQUATION?

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Population ecology is used to explain the role of human resource management (HRM) in enhancing the performance of initial public offering (IPO) companies. We examined the determinants of structural inertia and developed hypotheses on the relationship between HRM and organizational performance. The results indicate that two human resource variables, human resource value and organization-based rewards, predict initial investor reaction and long-term survival. The rewards variable negatively affects initial performance but positively affects survival.

A growing body of literature focuses on the impact of human resource practices on organizational performance (Fisher, 1989; Huselid, 1994; Mahoney & Deckop, 1986; Truss & Gratton, 1994). This research generally falls under the title of strategic human resource management (SHRM). SHRM is different from traditional human resource management in its focus on organizational outcomes, its integration of the various functional areas of human resource management, and its concern with a more macro perspective on the topic (Lundy, 1994). The field has progressed significantly; however, inadequate definitions and sparse theoretical development (Dyer & Kochan, 1994; Kochan & Dyer, 1993; Zedeck & Cascio, 1984) continue to plague it, and only a handful of studies have used multi-industry, multifirm samples with independent measures of firm performance (cf. Abowd, Milkovich, & Hannon, 1990; Huselid, 1995; Ichniowski, 1990).

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Although numerous theories of organization exist, much of the research in SHRM has focused primarily on one view, that posited by strategic contingency theory (Fisher, 1989; Wright & McMahan, 1992). The result has been a number of "fit," or "matching," models suggesting that in order to enhance performance, organizations should implement human resource management policies that support their business unit or organizational strategies (Baird & Meshoulam, 1989; Huselid, 1994; Miles & Snow, 1984; Tichy, Fombrum, & Devanna, 1982). Although popular, this theory is limited in its ability to predict the performance of young companies that quickly change strategies. As will be discussed later in this article, its seems implausible that a firm's human resource strategy can or should continue to change in order to continue matching its business strategy. Therefore, in order to expand both the theoretical and empirical work in the field of strategic human resource management, we have developed a different theoretical perspective and tested hypotheses developed from this theory with a unique sample that allowed us to investigate the impact of human resource management issues on the ultimate measure of performance, firm survival. The research elaborates upon the theoretical work conducted by population ecologists to explain the role that human resource management might play in the survival and performance of a group of firms that were, for the most part, small and growing. Such organizations, which have been overlooked by human resource management researchers, are an important part of the economy because they are a significant source of new jobs and innovations (Birch, 1987). They also provide a unique opportunity to study how SHRM can affect a firm in its early stages of development.

Most of the strategic human resource management research has been conducted with cross sections of large, established organizations, while targeting the practices of their human resource departments. The dominant research method involves sending surveys to human resource professionals; therefore, the process ultimately results in samples of large firms that have human resource departments (Jackson, Schuler, & Rivero, 1989). Even when samples are drawn from sources that include smaller and newer organizations, such as Compact Disclosure, a database that compiles information from Securities and Exchange Commission (SEC) filings (e.g., Abowd et al., 1990; Huselid, 1995), the research designs used often result in larger, older firms being selected for analysis. The process of obtaining survey data to measure human resource strategy results in a final selection (because survey data are matched with archival data) of only those firms with human resource departments (Snell & Dean, 1994). When a human resource department is not surveyed (such as in Abowd and colleagues' study), other factors often limit the sample to larger firms. For example, Abowd and colleagues coded announcements in the *Wall Street Journal* to capture human resource management initiatives, but that publication seldom picks up press releases about smaller firms. A few organization-level studies have concentrated on specific industries—MacDuffie (1995) studied auto assembly plants, and Arthur

(1995) researched steel minimills—but the firms studied were also established and older.

Although previous studies have contributed to understanding macro human resource issues, several problems exist when human resource management is studied in large, established organizations, and these issues cannot be addressed without expanding the research into more diverse samples. First, the actions taken by corporate offices (in particular, by headquarters human resource departments) might not translate into the behaviors of managers at the division, business unit, or plant level. For instance, having a performance appraisal system or an extensive selection methodology in place might not indicate the degree to which employees or management really use these programs; it might merely reflect the staffing level of a personnel department (it has more people, so it can develop more programs). Thus, data from corporate human resource managers might not be tapping the underlying construct of interest in this research; instead, it might be measuring the activity level of human resource departments. In addition, the reliance on large, established organizations automatically limits variance in performance because these firms have survived their early years and are, as a result, in a better position to continue to survive.

Smaller, newer organizations present a unique opportunity for studying human resource management and perhaps to more adequately address causation. As Romanelli noted, "New organizations are notoriously poor at surviving their early years" (1989: 369). Thus, samples of small, young firms will show more variation in performance measures, including firm survival. Newer, smaller businesses do not usually have formal human resource management departments; as noted, that is one of the reasons they have not been studied in the past (Snell, 1992). However, we think that the "missing" department and the application of population ecology provide an opportunity to establish a different operational definition of the construct underlying the strategic human resource management literature. The variable focuses on an organization's overall strategic approach toward its employees as evidenced by actions of its top management team rather than on policies implemented and administered by the human resource department.

Initial public offering (IPO) firms, which are the focus of this research, have not been studied by researchers in strategic human resource management. IPO firms are organizations that offer their stock to the public market for the first time; they are moving from private to public ownership. The move is not an easy one, and it requires at least a year of effort, particularly on the part of a company's top management team to prepare and market the company. In addition, the firm undergoes numerous internal changes as it prepares to become "professional" and submit to the scrutiny of shareholders, investment bankers, and the Securities and Exchange Commission.

IPO firms present a unique opportunity to study young, small organizations that are undergoing dramatic change. These firms often are considered to be more successful than other small organizations because they have survived to this stage. However, they still face a risk of failure that is comparable to the high level encountered by other start-up organizations. Of the 3,186 companies that went public in the 1980s, with stock listed on the New York or American stock exchanges or NASDAQ, only 58 percent were still listed by December 31, 1989 (Zeune, 1993). Comparably, a Dunn and Bradstreet study showed that 53 percent of all failures and bankruptcies of firms in 1980 occurred less than five years after the firms' foundings (Romanelli, 1989). Therefore, even though it may seem that initial public offering firms are more successful than other small firms, they still face significant risks of failure.

We used population ecology as a framework for examining the relationship between human resource management and organizational performance within initial public offering firms. Population ecology is particularly useful for studying these organizations because it focuses on determinants of organizational survival, a dependent variable that has received very little attention from HRM researchers. According to Abowd, Milkovich, and Hannon, "Research on the relation between human resource decisions and organizational performance appears to have focused most on immediate outcomes (behavior and attitudes), less on intermediate outcomes (accounting measures, firm health, and economic outcomes), and hardly at all on ultimate outcomes such as survival" (1990: 204).

We applied population ecology to the study of human resource management in order to understand how human resource decisions made at an early stage (the time of an IPO) might affect long-term performance (survival after five years). Although population ecologists have discussed human resource determinants of organizational survival, this aspect of the theory has not been adequately developed. Therefore, the first section of this article reviews population ecology to explicate its implications for the relationship between human resource management and organizational performance. Population ecology allowed us to develop hypotheses about a firm's long-term performance; however, it is not helpful in explaining the outcomes of the actual initial public offering process. Therefore, we also conducted an exploratory analysis of the effect of human resource management on investor reaction to firms. The next section describes the findings of a study based on a sample of 136 firms that initiated their public offerings in 1988. Finally, we consider the ramifications of these results for the field of SHRM.

POPULATION ECOLOGY AND HUMAN RESOURCE MANAGEMENT

Wright and McMahan, after reviewing the strategic human resource management literature and noting its dependency on contingency-based or strategic choice models, concluded that "a variety of theoretical models exist in the organization theory literature . . . these models may also serve as fertile ground for broadening our perspective of the role of human resource management in organization" (1992: 315). Even though they included population ecology as one such model, it has not been adequately utilized by researchers in the field. Perhaps this omission results from the conclusion of some organization theorists that according to population ecology, the role of managers is passive or inactive (Astley & Van de Ven, 1983; Singh & Lumsden, 1990). Morgan noted that "the population ecology view has been much criticized for downplaying the importance of choice of strategic direction for an organization" (1986: 68). If managerial actions cannot augment firm performance, then human resource management practices, which are implemented by managers, would not appear to be important in predicting organizational outcomes. Many management scholars seem to have accepted this view; however, the conclusion that managers' actions cannot affect firm performance is currently being debated, and some population ecology researchers have rejected it (e.g., Amburgey, Kelly, & Barnett, 1992; Haveman, 1992, 1993). We contend that there is nothing inherent in the theory that implies management actions and decisions are not important; in fact, we will show that population ecology has implications for understanding how human resource management can have an impact on firm survival.

Population ecology was developed as an alternate view of how organizational forms change over time. The dominant paradigm before population ecology was introduced focused on the way in which managers and strategic choice affect firm performance. Freeman and Hannan commented that they "thought it was a mistake to build models of organizational change that rely on anthromorphic images of organizations or on heroic images of managers; [they] attempted to build a perspective that treats organizations as complex systems with strong limitations on flexibility and speed of response" (1989: 426). Thus, those theorists focused on advancing an alternative theory of organizational change, and in doing so they employed populations of organizations rather than individual corporations as their units of analysis. The theory has been used to explain the impact of competition, firm age, environmental turbulence, and technology on variance in organizational forms and survival over time (Astley & Van de Ven, 1983; Hannan & Carroll, 1992). Although it may not have been stated, population ecology *does* have implications for the internal management of companies. Discussions of structural inertia center on the importance of human capital and the way in which processes are managed to produce reliability and accountability, which are posited to be determinants of survival (Freeman & Hannan, 1990).

According to the strategic choice and contingency theory literatures, managers can respond to environmental conditions by altering their business strategies, and this action should lead to improved performance (Lyles, 1990). In the SHRM literature, authors have elaborated upon this idea by suggesting that, as a subsequent (or concurrent) step, human resource policies should be changed to match the new or altered business strategies (Dyer, 1984; Lengnick-Hall & Lengnick-Hall, 1988; Milliman, Von Glinow, & Nathan, 1991). Strategic human resource management suggests that there is no one best way to manage employees but that instead each firm should tailor its programs to meet the challenges and needs of its business strategy and environment. In fact, Baird and Meshoulam (1988), who developed a model specifying how human resource management strategies should evolve, claimed that if a company's human resource department does not make timely changes, it will be ineffective. They argued that "if human resource activities skip a stage, they will be ineffective. It will be necessary to revisit an earlier stage for the unit to regain its effect" (1988: 122). This argument means that a human resource department cannot be more "advanced" than the rest of a company. Baird and Meshoulam also stated that new leadership within human resources is required at each stage of the life cycle. This view implies dramatic and frequent changes guided by business strategy and life cycle. But new leadership and constant change also put pressure on organizations, and it is this type of pressure that, population ecologists suggest, leads to disruption and increases the risk of organizational death.

Population ecologists take a different approach in that they claim too many organizational change efforts (such as changing human resource practices to match a current environment, business strategy, corporate strategy, or life cycle) will have a negative impact on organizational performance and survival. At the core of population ecology is the concept of inertia (Hannan & Freeman, 1984). Although inertia often conjures up images of stale, immobile organizations, the term does not necessarily mean "standing still." Newton's first law of physics states that an object at rest tends to stay at rest and an object in motion tends to stay in motion. This overall tendency to stay at rest or in motion is called inertia. Webster's dictionary defines inertia as "a property of matter by which it remains at rest or in uniform motion in the same straight line unless acted upon by some external force." An organization that has inertia might be at rest, but it might just as well be moving forward, until it is acted upon by something that causes the entire organization to move in a different direction. Inertia keeps an organization moving during a change, even though the direction has changed. We know that initial public offering firms are not at rest because they are entering the public market in order to grow; therefore, for IPO firms, inertia is a desirable characteristic because it helps them to continue moving forward.

Population ecology arguments imply that, rather than alter human resource systems to match life cycle or business strategy (as contingency theory suggests), organizations should design human resource techniques to strengthen structural inertia early in the life cycle, and in this way increase their survival chances. Population ecology is applicable to the study of human resource management because there is a relationship between HRM practices and structural inertia. If human resource management can increase inertia, then HRM systems will contribute to the long-term performance and survival of organizations.

Population ecology claims that reliable companies producing collective action—people working together toward a common goal—are more likely to survive, and the most reliable firms are those with characteristics that enhance high structural inertia (Freeman & Hannan, 1990; Hannan & Freeman, 1989). We suggest that collective action and structural inertia imply the presence of *structural cohesion,* an employee-generated synergy that propels a company forward, and this quality enables firms to respond to their environment while still moving forward. High inertia results from a variety of internal and external factors. Internal factors include sunk costs, high levels of investment in personnel or human capital and technology, and political coalitions; external factors include the legal environment, market conditions, and the pace of technology change. Although population ecology researchers have not focused on the personnel or human capital component, there is a theoretical argument for investigating this element.

A few implications for human resource management can be drawn from discussions of the internal pressures that create structural inertia. Hannan and Freeman (1977) suggested that investments in personnel, particularly in specialized employees, increase inertia. Investments in personnel are usually made because a firm's managers think its employees are important to the business. Although many initial public offering firms do not have formal human resource departments and the types of policies and procedures that are implemented by these departments, IPO firms do vary in the degree to which they consider employees to be an important part of their business. This variance is evidenced by the degree to which they acquire specialized personnel and make other investments in employees (training, support systems, etc.). Smaller companies rely on high levels of cooperation and flexibility from their employees because they are usually understaffed, and they do not have excess resources; in order to meet the demands of a changing environment, they need to rely on each individual employee to contribute. If a company has high inertia as a result of a strong, cohesive workforce, it is more likely to be able to marshal those resources to respond to its challenging environment.

Analyses of strategic human resource management have not included a variable measuring variance in the degree to which firms consider employees important to business. We capture this variance as *human resource value* and suggest that it affects survival chances because it increases structural cohesion. In summary, we conclude that companies placing higher value on employees early in their development (at the time of an IPO) will improve their chances of survival. Employees will reciprocate by placing high value on the organization and its goals, thus increasing the company's chances of survival.

> *Hypothesis 1: Organizations that place more value on employees at the time of their initial public offerings will increase their survival chances.*

Compensation programs might also affect inertia by encouraging and rewarding collective action. Hannan and Freeman (1984) noted that diversity of interests among members of an organization and uncertainty about means-end relationships lead to a weak political environment that can reduce inertia. Their reasoning is that these conditions encourage employees to pursue separate goals (creating dispersed action and a lack of cohesion), and these individual objectives may be in conflict with each other, the overall mission of the firm, or both. Much of the literature on individual incentives and team bonuses show that these pay programs have similar dysfunctional outcomes (for a review, see Gomez-Mejia and Balkin [1992]). Individual incentives tend to encourage employees to maximize their own incomes by engaging in behaviors that are often inconsistent with the needs of the company. Team-based incentives can also create an environment that sets groups in competition with each other, leading to lower organizational effectiveness (Welbourne & Gomez-Mejia, 1991).

Pay based on organizational performance, however, links all employees to a firm and its mission, thus encouraging collective action and decreased competition between individuals and between work teams (Lawler, 1981; Milkovich & Newman, 1993; Welbourne & Gomez-Mejia, 1995). Companies that implement compensation systems based on organizational performance (such as stock options, profit sharing, and the like) will be more likely to retain employees and rally these individuals around a common goal (Kruse, 1993), thus enhancing inertia and structural cohesion. Organization-based compensation programs provide employees with a longer-term perspective on the business, which should also assist in sustaining the type of inertia that can improve long-term survival chances.

> *Hypothesis 2: Companies having organization-based compensation programs at the time of their initial public offerings will be more likely to survive.*

The role that human resource management can play in strengthening inertia and enhancing survival is particularly applicable to companies at the initial public offering stage. Population ecology suggests that the internal structures in place at times such as the IPO, when firms are past infancy and are entering a new stage of growth, will be critical in determining organizational chances of survival because these basic structures are not likely to change (Aldrich & Marsden, 1988; Hannan & Carroll, 1992). This view seems consistent with the conclusions of compensation researchers who have observed that rewards programs are resistant to change (Gerhart & Milkovich, 1990; Gomez-Mejia & Balkin, 1992). Snell and Dean noted that "once in place, administrative systems, such as compensation systems, are notoriously intractable" (1994: 1118).

SHORT-TERM IPO PERFORMANCE

Population ecology provides little direction for predicting how investors will react to firms with high levels of human resource value and organization-based rewards. However, given that the goal of an initial public offering is to raise cash for the company and that the amount of cash raised is maximized by obtaining a high stock price, it seems useful to examine the impact of the human resource variables on initial public offerings.

This issue is particularly interesting because the way in which initial stock prices are set is not well understood. Given the relatively short operating history of IPO firms, it may be difficult to judge their future value (Altman, 1988; Wat, 1983). Overall, a stock price is set through a series of negotiations between an underwriter and a company. The process has been called more of an art than a science (Hofmeister, 1987: 53), and it has been suggested that mathematical models and accounting models are "rarely more than a portion of the ingredients which make up the determination of final price" (Weaver, 1969: 33). Indeed, several prospectuses we examined for this research even stated "price determined by negotiations between the company and the representatives of the underwriters and bears no relation to the assets, earnings, or book value, or any other established criterion of the value of the company."[1]

Even though the process might not be well understood, the underwriters and companies have a significant amount of information with which to make a pricing decision. Underwriters, lawyers, and accountants are all involved in evaluating a company before finalizing its prospectus. Prior to the actual pricing date, the company conducts what is called a road show, a tour consisting of a series of group meetings and one-on-one sessions in which the management team attempts to sell the firm to large institutional investors. Investors then make a buy decision based on both the prospectus and the information obtained in these meetings, and this decision is communicated to the underwriters before the stock price is finalized. Thus, the underwriters also use expected investor reaction obtained through the road show to help determine final stock price.

Therefore, even though there might not be sufficient theory or research on how IPO firms are priced, the decision seems to be one that is made in light of a considerable amount of facts about the firms and the probable market reaction to them. The question that this research addressed is whether human-resource-related data are used as part of the pricing decision, and if so, in what way potential investors evaluate that information.

METHODS

The target population for the study was companies that were preparing to move into a new stage of growth and needed an infusion of cash. Initial public offering firms have been neglected in the human resource management literature, but they represent an important sector of the economy. Successful IPO firms typically are smaller, rapidly growing companies that have the potential to create large numbers of jobs and introduce new technologies (Birch, 1987). Although these firms must offer enough potential to attract investors, they usually have short operating histories and present higher risks than larger, more established firms (Beatty & Zajac, 1994).

Sample

The sample used for this study contains 136 nonfinancial companies that made their initial public offerings in 1988. A total of about 250 firms filed securities registrations with the SEC to conduct an IPO in that year, and we pared the list down to 170 by deleting those that were listed as closed-end funds or real estate investment trusts and other firms not producing a good or service. Upon receiving the 170 prospectuses, we eliminated additional firms that produced no good or service. The year 1988 was chosen because it was five years before 1993, the year in which we began the research. Prior studies have shown that about 50 percent of IPO firms are in business five years after their initial offerings. Thus, collecting five years of follow-up data permitted a comparison between survivors and nonsurvivors.

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[1] The prospectus is a document provided to the SEC prior to a public offering and is also circulated by the underwriters to assess demand for a firm's stock.

Data were gathered from the prospectus of each firm. The SEC requires firms to follow strict guidelines in the format of prospectuses. The document itself is usually written by members of a firm's management team and then scrutinized by lawyers and accountants.

Although the potential for positive bias exists in the prospectus, the firm is liable for any information that might mislead investors (O'Flaherty, 1984). The amended Securities and Exchange Act of 1934 sets the requirements for prospectuses, thus assuring consistency in the type of information that is included in the documents. The SEC also requires that a prospectus be accurate to the best knowledge of management. Given this requirement and the fact that the SEC requires a tremendous amount of detail regarding company operations, prospectuses are a useful data source (Marino, Castaldi, & Dollinger, 1989).

Data Collection and Coding

Prospectuses from 1988 are not readily available in public sources; therefore, copies were obtained from Compact Disclosure. We were able to acquire the prospectuses for the companies that initiated an initial public offering during 1988. Data were coded using a two-step process incorporating two coders who were unaware of the survival status of the companies as they coded.

First, a five-page summary of each prospectus was constructed. Given the fact that the prospectus is not a traditional data source, this first step allowed for careful reading of each document, cross-checking at the second stage of coding, and notation of any unusual firm characteristics. The second step involved numerically coding each five-page summary for specific information. Researchers cross-coded a sample of companies (two people coded the same prospectus), and they switched companies for the second stage of coding. Any questions about codes were resolved through group consensus, which involved meetings with the coders and an additional researcher.

Sample Characteristics

The average firm incorporated in 1981, although half incorporated in 1985 or later. Half the firms employed fewer than 110 workers; however, 20 percent had 700 or more employees. On average, the firms had six executive officers and three outside directors. The businesses were located throughout the United States but were most heavily concentrated in the Pacific states and were in numerous industries, ranging from food service retailing to biotechnology to steel minimills. Table 1 gives industrial and geographical distributions, and Table 2 gives descriptive statistics for the sample. As of 1993, 81 firms survived.

Independent Variables

Human resource value. Testing Hypothesis 1 required a measure of human resource value. This variable attempts to assess the degree to which a company values employees as a specialized asset. Given that the prospectus describes a company's competitive advantages, it is a useful source for understanding how the firm values its employees. If employees are considered to be a source of competitive advantage, a firm's strategy, mission statement, and operating practices should reflect that value. We attempted to capture human resource value by coding a variety of indicators found throughout the prospectuses.

This measure was computed as the sum of ratings on several items coded 1 if the firm engaged in the practice and as 0 if not. The items included the following: (1) The company's strategy and mission statements cited employees as a competitive advantage. (2) A training program for employees was mentioned, indicating allocation of resources that resulted in employees obtaining company-specific education. (3) An officer with responsibility for human resource management was present. (4) Full-time employees, rather than temporary or contract employees, were regularly used. Companies that used temporary workers were coded as 0, which lowered their overall score on HR value, and companies using full-time, permanent employees were coded 1. (5) The SEC requires employers to rate their employee relations climate. Three codes were used for this item: 0 for poor or satisfactory relations, 1 for good relations, and 2 for excellent relations with employees.

Values on the summed overall HR value variable ranged from 0 to 6, with a mean of 2.57 and standard deviation of 1.15. We were not able to calculate statistics for internal reliability because the overall measure is summated. Basically, this scale indicates the *degree* to which a company values its employees as evidenced by the pervasiveness of various indicators of human resource value. Table 2 gives descriptive statistics for the scale items.

Organization-based rewards. Hypothesis 2 focuses on the use of rewards based on organizational performance. Employers can design organization-based compensation systems (such as stock options and profit sharing) for all employees or for only management teams; therefore, we coded the existence of rewards programs for both populations. The measure was computed by adding responses to the following dummy indicators: stock options for all employees, stock options for key employees and management, profit sharing for all employees, profit sharing for key employees and management, and other forms of group-based incentives (gainsharing, customized rewards) for all employees or for management. Values ranged from 0 to 5, with a mean of 1.79 and a standard deviation of 1.17 (see Table 2 for item means).

TABLE 1
Sample Distribution

Type of Distribution and Code	Industry	Frequency
Two-digit SIC classification		
01	Agricultural production, crops	1
02	Agricultural production, livestock	1
20	Food and kindred products	3
22	Textile mill products	2
23	Apparel and other finished textile products	1
26	Paper and allied products	1
27	Printing, publishing, and applied industries	2
28	Chemicals and allied products	7
30	Rubber and miscellaneous plastics products	1
33	Metal industries	2
34	Miscellaneous fabricated metal, fabricated structural metal products	1
35	Machinery, except electrical	8
36	Electrical machinery, equipment, and supplies	7
37	Transportation equipment	3
38	Professional and photographic equipment, and watches	7
39	Toys, miscellaneous manufacturing industries	16
44	Water transportation	1
45	Air transportation	1
48	Communications	3
49	Utilities and sanitary services	3
50	Wholesale trade; durable goods	4
51	Wholesale trade; nondurable goods	3
54	Retail trade; grocery stores	1
56	Retail trade; apparel and accessory stores	1
57	Retail trade; household appliances, TV, radio stores	1
58	Eating and drinking places	1
59	Retail trade; miscellaneous stores, drug stores	3
60	Banking	1
61	Savings and loans; credit agencies	1
64	Insurance	1
65	Real estate	1
66	Security, commodity, and investment companies	1
71	Unknown	1
73	Business services and repair (not automotive)	7
75	Automotive services and repair	2
78	Theatres and motion pictures	1
80	Physicians offices, health services	3
83	Child day care	1
86	Membership organizations	1
87	Other social services	4
89	Engineering, architectural, surveying, miscellaneous services	2

TABLE 1 (continued)

Type of Distribution and Code	Industry	Frequency
Small Business Administration industry groupings		
	Agriculture	2
	Manufacturing	62
	Transporation	9
	Wholesale trade	7
	Retail trade	11
	Services[a]	43
	Missing	2
Geographic distribution		
	Foreign country	5
	Northeast	12
	Mid-Atlantic	24
	North Central	15
	South Atlantic	22
	South Central	16
	Mountain[b] & Pacific	42

[a] Because we excluded financial companies, we collapsed the financial category into the services category.

[b] Nine firms are located in the Mountain states.

Dependent Variables

The hypotheses predict that firms valuing their employees and using rewards based on organizational criteria will improve their survival chances. In addition, we were interested in understanding the impact of these variables on the initial public offering. Three different dependent variables were used to measure firm performance and survival. Two measures assess IPO financial performance, and the third measures long-term performance. Because firms making their initial public offerings are so young, we could not employ many of the measures of firm performance used in prior strategic human resource management research, such as productivity (Kruse, 1993; MacDuffie, 1995), abnormal returns (Abowd et al., 1990), and ratio data such as return on assets (Huselid, 1995). IPO firms are new to the stock market, often lack productivity data (it is not available, or no product is produced yet, or both), and zero would have to be used for many of the ratio measures of performance as many of these firms have no sales (Eisenhardt & Schoonhoven, 1990).

Perceived market potential. The absolute stock price at the time of IPO, while important, can be misleading in that it fails to account for the worth of firm assets. A high-tech start-up may have enormous potential, but it is unlikely to garner a high stock price because it will have very few assets. Conversely, a steel mill may command a high stock price, but much of that value may lie in equipment. In order to control for assets, we used the percentage of the share price that was the price premium in the analysis

TABLE 2
Descriptive Statistics for the Sample and the Independent Variables

Variables	Mean	s.d.
Sample characteristics		
Year incorporated	1981	12.15
Number of executives	5.67	2.83
Number of outside directors	3.17	2.10
Number of employees	729	2,054
Unionized[a]	0.14	0.35
Percent stock owned by directors and executives after the IPO	38.91	22.30
Percent of firm stock sold in IPO	25.40	9.80
CEO age[b]	47	9
CEO salary[b]	173.80	182.20
Expected IPO proceeds[b]	12.16	16.91
Human resource value		
Executive with HR responsibility	0.20	0.40
Use full-time employees	0.71	0.46
Have an employee training program	0.15	0.36
Cite employees as strategic asset	0.51	0.50
Quality of employee relations	1.00	0.52
Organization-based employee rewards		
Stock plan for all employees	0.49	0.50
Stock plan for management	0.85	0.36
Profit sharing for all employees	0.12	0.32
Profit sharing for management and key employees	0.20	0.40
Other incentive, all employees	0.10	0.30
Other incentive, management	0.05	0.22

[a] 1 = yes; 0 = no.

[b] Age is in years; CEO salary is in thousands of dollars; proceeds is in millions.

(Rasheed & Datta, 1994). The premium is the amount of the stock price that is above and beyond the book value, and it represents the perceived potential value of a firm.

For example, consider two companies selling their stock at \$10.00 per share. Firm X has a book value of \$2.00, and firm Y has a book value of \$6.00. Firm X is a more risky investment, because if it goes bankrupt, its assets are only worth \$2.00, but those of firm Y are worth \$6.00. For firm X and firm Y to command equivalent stock prices, an investor must believe that firm X has the potential to do very well. The difference between the stock price and the book value is called the dilution value, since it represents a dilution to investors purchasing the stock. However, from the company's perspective, it is a price premium. The company attempts to maximize this premium in its offering, and investors wish to minimize the premium so that their investments are more secure. The price premium is a useful measure of performance, since it measures the perceived potential of the firm (Rasheed & Datta, 1994). To standardize this premium across all firms, we divided it by the total share price, to obtain the percent premium. The calculation was as follows: *percent price premium = (stock price − book value)/stock price.*

Tobin's Q. We also calculated Tobin's *Q*, a more traditional measure of the perceived potential of a firm, as initial stock price over book value. By using initial stock price, we measured the reaction of the initial investors (primarily institutional investors) to a firm.[2] Although book value is historic, and therefore not an exact approximation of replacement cost (which is intended in the calculation of Tobin's *Q*), authors have recommended the stock price to book ratio as a measure of investor reaction to a firm (Smirlock, Gilligan, & Marshall, 1984). Tobin's *Q* therefore indicates how potential investors value the firm; the higher the ratio, the more it is valued (Davis, 1991; Davis & Stout, 1990). The calculation is as follows: *Tobin's Q = (stock price/book value).*

Survival. A third dependent variable, testing the population ecology hypotheses and reflecting long-term performance, was survival. All firms still in business at year-end 1993 were coded as survivors. Survival status is not easily determined, so we took several steps to assure correct identification of survivors.

First, we searched an on-line database of current public firms to find current information on the companies. Supplemental information was gathered from Compact Disclosure, through which we were able to identify many active and inactive companies. The Directory of Obsolete Securities (1994) was also searched to identify bankrupties, name changes, recapitalizations, and mergers. In addition, we made phone calls to the numbers provided in the prospectuses. Fourteen firms (10%) had changed their names between the time of their initial public offering and 1993, and we called these firms to find out whether the name changes were cosmetic, or whether the businesses had undergone other major transformations. Merged firms were considered to be nonsurvivors under the logic that the firm coded in 1988 had been joined to another management and organizational culture (Aldrich & Marsden, 1988; Kalleberg & Leicht, 1991). In addition, we tracked the stock prices of the mergers and determined that seven out of eight merged firms had stock prices that decreased prior to the merger; therefore, the trend in this sample seemed to be that mergers reflected nonsurvival rather than survival. Overall, 81 companies, or 59.6 percent of the sample, were coded as survivors.

Control Variables

Several control variables, selected on the basis of reviews of both the strategic human resource management and initial public offering literatures

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[2] A more conventional approach might be to use seven-day stock price, which measures market reaction after a company is traded. However, the focus of this research was on the reaction of individuals who were familiar with a firm; therefore, we used initial price. However, seven-day and initial stock price are strongly related, with a correlation of .96. The correlation between Tobin's *Q* calculated with initial price and Tobin's *Q* calculated with seven-day price is .90. Both are significant at the $p < .001$ level.

(e.g., Beatty & Zajac, 1994; Huselid, 1995) were used in the analysis. The total number of employees, logged to correct for skewness, was included as a measure of size. We added net profit per share at the time of the IPO as a performance measure, using net profit because many firms had net losses reported, which indicated variance in performance. Other measures of performance, such as sales, presented the problem of zero sales for many organizations in the sample. A dichotomous measure coded 1 for a service industry and 0 for manufacturing was used to control for industry. This dichotomous code was used in the reported analyses; however, we also conducted analyses using dummy variables for a more detailed industry categorization (the six Small Business Administration categories listed in Table 1), and the results appear in notes to the tables. We also included geographic area as a control; again, the results appear in notes to the tables. A total of seven geographic areas were included, with the Northeast being the omitted category (see Table 1). A final control variable indicated the level of a firm's risk. Each prospectus contains a section listing all risk factors faced by the firm, which must be disclosed to meet the requirements of the Securities and Exchange Commission. Prior research on initial public offering firms has shown that this measure is a useful way to code risk (Beatty & Zajac, 1994; Rasheed & Datta, 1994). The presence of the following risk factors were included in this measure: technological obsolescence, new product, few or limited products, low number of years in operation, inexperienced management, technical risk, seasonality, customer dependence, supplier dependence, inexperienced underwriters, competition, legal proceedings against company, liability, and government regulation. The summated risk measure ran from 1 to 11, with a mean of 4.18 and a standard deviation of 1.80. Table 3 gives correlations, means, and standard deviations for all of the dependent variables and control variables. Company age was significantly correlated with size, risk, and profit per share, so it was not included as a control in the analyses reported. However, we conducted a separate analysis with age included as a control (both with and without the expanded list of industry variables), and the results appear in notes to the tables.

RESULTS

As Table 3 indicates, human resource value is positively related to survival, and organization-based rewards is negatively related to measures of initial stock performance and positively related to survival five years after an initial public offering.

Dependent Variables

Percent price premium. Table 4 shows the regression analysis results for percent price premium. The R^2 for the full model is 15, which is significant at the .07 level. HR value has no effect on price premium; however, the rewards variable has a negative and significant (at the .05 level) impact on price premium. This model suggests that investors ignore information related to the degree to which firms value their employees, but they react negatively

TABLE 3
Correlations and Descriptive Statistics for Variables Used in the Analyses[a]

Variables	Mean	s.d.	1	2	3	4	5	6	7	8
1. Tobin's Q	4.72	9.39								
2. Percent price premium	68.62	24.40	.23							
3. Survival	0.60	0.49	−.10	−.24						
4. HR value	2.57	1.15	.05	.05	.19					
5. Organization-based rewards	1.79	1.17	−.18	−.20	.32	.21				
6. Risk level	4.18	1.80	−.04	.21	−.02	−.12	−.02			
7. Number of employees	4.56	2.61	−.11	−.09	.06	.33	.27	−.31		
8. Service industry	0.46	0.50	.14	.06	−.12	.04	−.18	−.07	.01	
9. Net profit per share	0.88	2.25	.07	−.11	.20	.19	.20	−.37	.46	−.11

[a] All correlations above .18 are significant at the .05 level; those above .25 are significant at the .01 level, and those above .27 are significant at .001 level.

TABLE 4
Results of Regression Analyses[a, b]

	Without Controls		Without HR		Full Model	
Variables	*b*	s.e.	*b*	s.e.	*b*	s.e.
Percent price premium						
Intercept	71.66**	5.68	67.93**	11.18	72.31**	12.14
HR value	2.03	1.90			1.57	2.08
Rewards	−4.53*	1.86			−4.96*	1.99
Risk			3.21*	1.38	3.49*	1.36
Number of employees			−0.32	0.98	−0.05	0.99
Industry			2.93	4.50	1.16	4.48
Net profit per share			−0.34	1.13	−0.07	1.13
R^2	.05		.10		.15	
F	3.13*		1.29		1.66†	
Tobin's Q						
Intercept	5.80**	2.20	15.39**	4.22	17.09**	4.60
HR value	0.71	0.74			0.46	0.79
Rewards	−1.62*	0.72			−1.72*	0.75
Risk			−0.25	0.52	−0.15	0.51
Number of employees			−0.82*	0.34	−0.71†	0.38
Industry			2.59	1.70	1.99	1.70
Net profit per share			0.74	0.43	0.84*	0.43
R^2	.04		.14		.18	
F	2.64†		1.91*		2.08*	

[a] Unstandardized coefficients are reported. The full model also includes dummy codes for geographic areas, which were significant.

[b] The analysis was run with an expanded list of SIC codes (those reported in the Small Business Administration publications). None of the SIC codes were significant, and the pattern of results did not change. For percent price premium, the overall R^2 for that equation was .16 (not significant). The coefficient for HR value was 1.75, and for rewards it was −5.01 (significant at the .02 level). The risk variable was still significant at the .05 level, and the coefficient was 3.11. For Tobin's Q, the overall R^2 for the expanded equation was .19 (significant at the .10 level). The coefficient for HR value was 0.51, and it was −0.71 for rewards (significant at the .05 level). Profit per share was significant at the .08 level, and the coefficient was 0.75.

A second analysis was run including company age as a control. Age was not significant, and the rewards variable continued to be significant.

The regression with Tobin's Q calculated with seven-day stock price was conducted with data from 82 firms because seven-day price was not available for the entire sample. The R^2 for the equation is .19, $F = 1.32$. The regression coefficient for HR value is −0.15 with a standard error of 0.52 (not significant), and the coefficient for rewards is −0.49 with a standard error of 0.52 (not significant).

†$p < .10$

*$p < .05$

**$p < .01$

if firms use compensation to link pay to organizational performance. The geographic area codes had a significant effect on price premium. In addition, the risk factor had a positive impact on price premium.

Tobin's *Q*. Table 4 also shows results of the analysis with Tobin's *Q* as the dependent variable. The results are similar to those for price premium in that human resource value had no impact on performance, but the rewards variable had a significant (at the .03 level) and negative impact. This pattern should not be surprising as the two measures are definitionally related; both take stock price and book value into consideration but arrange the terms differently. The geographic variables continued to affect performance; however, in this analysis risk had no significant effect, and net profit per share had a positive impact. In addition, size had a negative effect.[3]

Survival. The hypotheses state that companies with higher inertia are more likely to survive, and this research examines the degree to which human resource value and organization-based rewards, as indicators of inertia, contribute to a firm's survival. We tested the hypotheses by determining whether there were differences in HR value and rewards between the two groups, survivors and nonsurvivors. To do this, we conducted a multivariate analysis of variance (MANOVA).

The results indicate that there is a significant difference between the survivors and nonsurvivors on the two variables of interest (Wilks's lambda = .88, $F = 8.70$), and the subsequent univariate analyses show that the largest difference (at the .001 significant level) lies in the rewards variable. The mean for the survivors was 2.10, and the mean for the nonsurvivors was 1.34 ($p < .01$). The mean for the human resource value variable for survivors was 2.74, and the mean for the nonsurvivors was 2.30 ($p < .10$).

Table 5 presents the results of a logistic regression analysis. Logistic regression was used because the dependent variable consists of only two values (Allison, 1984; Yamaguchi, 1991). The overall model is significant at the .01 level, and the classification table indicates that the model predicts survival at a 71 percent accuracy level. The only variables significant at the .05 or less level are human resource value and rewards, and both variables predict survival in a positive direction. Net profit per share has a positive and significant impact on survival (at the .10 level).

In order to understand the degree to which these two variables are important for survival, we next assessed the practical implications of the two variables on the probability of a firm's surviving until 1993. As the logistic regression model is nonlinear, the magnitude of the effect of human resource variables on survival differs conditionally across levels of values and rewards. Still, the probability of survival can be estimated at several critical values in order to gain a general understanding of these effects. The

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[3] We ran the same regression equation using Tobin's *Q* calculated with seven-day stock price rather than initial stock price; results are noted in Table 4, footnote b.

TABLE 5
Results of Logistic Regression Analysis for Survival[a, b]

	Without Controls		Without HR		Full Model	
Variables	*b*	s.e.	*b*	s.e.	*b*	s.e.
Intercept	−1.34*	0.54	−0.14	0.95	−1.81	1.19
HR value	0.28	0.18			0.40*	0.21
Rewards	0.61**	0.19			0.69**	0.21
Risk level			0.11	0.12	0.04	0.13
Number of employees			−0.05	0.09	−0.18	0.12
Industry			−0.40	0.39	−0.35	0.42
Net profit per share			0.28*	0.13	0.24†	0.13
χ^2	17.37**		14.08		30.23**	

[a] Unstandardized coefficients are reported. The full model also includes dummy codes for geographic areas, which were significant.

[b] When the analysis was conducted with the SIC codes reported in Small Business Administration publications, none of the SIC codes were significant, and the pattern of results did not change. The chi-square for that equation was 31.52 (significant at the .01 level). The coefficient for HR value was 0.42 (significant at the .05 level) and for rewards it was 0.72 (significant at the .001 level). Profit per share was significant at the .10 level, and the coefficient was 0.23.

In a second analysis with a control for company age, the chi-square was 36.22 (significant at the .004 level), and age was not significant (the coefficient was 0.04). The rewards and human resource value variables were still significant; the coefficient for rewards was 0.57 (significant at the .000 level), and the coefficient for human resources value was 0.38 (significant at the .08 level).

†$p < .10$
*$p < .05$
**$p < .01$

transformation from the logistic estimator into the probability of survival is as follows:

$$P(survival) = \frac{\exp(\Sigma\beta_k X_{ki})}{1 + \exp(\Sigma\beta_k X_{ki})},$$

where β is a parameter for the set of $k + 1$ parameters estimated in the logistic regression model for the k predictors $X_l \ldots X_k$ plus a constant term (Demaris, 1992).

With all variables held at the mean, the conditional probability of surviving until 1993 is .70. For a firm with a high level of human resource value (one standard deviation above the mean), the probability of firm survival increases to .79. For a firm whose human resource value is low (one standard deviation below the mean), the probability of survival drops to .60.

The effect of rewards on the chance of survival is even more dramatic. With all other variables held at the mean, a firm with a high level of employee rewards (one standard deviation above the mean) increases its chance of survival from the average of .70 to .87. A firm with a low level of employee rewards (one standard deviation below the mean) decreases its chance of survival from .70 to .45.

Holding everything else constant, a firm that has a high level of human resource value and a high level of organization-based employee rewards boosts its chances of survival to .92. This represents a gain of .22 over the average firm. When both human resource value and employee rewards are at a low level, the chance of firm survival decreases to .34, a level .36 lower than a firm with average scores on the human resource indicators has. Overall, both the level of human resource value and the level of organization-based employee rewards can greatly increase firm survival, although the effect of employee rewards is the stronger.

Contingency Models

We also tested an internal contingency approach to firm survival that is not included in the hypotheses. Contingency theory might lead to the hypothesis that a match between HR value (which represents a company's overall human resource strategy) and firm-based employee rewards should positively affect performance and survival. The implication is that companies placing low value on employees (this can be an intended or unintended strategy) should not use company resources to retain or reward these employees. In contrast, according to population ecology it is not the match that is important; rather, the increased levels of value and the greater presence of organization-based rewards affect performance. We tested the interaction between value and rewards by computing the models in Tables 4 and 5 with interaction terms, and those terms were nonsignificant in all cases.

In addition, contingency theory and prior strategic human resource management research suggest that the following interactions, which were tested in the survival analysis, might be significant: (1) risk and employee value, (2) risk and rewards, (3) size and employee value, (4) size and rewards, (5) profitability and employee value, (6) profitability and rewards. All of the possible interaction effects were included in six separate regression analyses, and none were significant. However, the employee value and rewards variables continued to have main effects on survival when the interaction terms were included.

DISCUSSION

The results provide initial support for extending population ecology to the study of human resource management. The survival analysis indicates that firms using organization-based compensation programs and valuing their employees are more likely to survive. However, although valuing employees is a neutral signal to investors, compensation programs that link employee wages to the success of an organization have a strong and negative effect. The market seems to react negatively to firms using their capital for employee rewards programs.[4] It may be that investors perceive human resource practices that transfer money from the company to employees negatively; this has been evidenced in other studies of compensation (Abowd et al., 1990; Kruse, 1993).

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[4] We divided the rewards variable into two components (management rewards and employee rewards) to see if one component was dominant in predicting performance. The results indicate that both had a negative relationship with initial performance and both positively predicted survival.

To supplement the findings of the study, we contacted a number of survivors and conducted structured telephone interviews. The telephone interviews were done with the most senior member (either CEO or vice president) of a company's management team who had been with the company since the IPO. A total of 40 individuals participated. Respondents were asked to rate a number of items according to their degree of importance to the company's performance since the IPO. Ratings could range from 1, "not at all important," to 5, "very important." These items were obtained from a review of the organizational survival literature. The Appendix lists the items, and Table 6 gives descriptive statistics, correlations, and reliabilities for variables.

It is interesting to note that of the six categories that were rated by these executives, the most important, in their opinion, was the top management team, and the least important was employee rewards (see Table 6). At the same time, when we asked these executives if there was anything about the way that they handled their employees that particularly helped or hurt them, we received responses like these: "Employee stock option plan helped a lot," "ESOP for all employees," "Bonus program based on pretax profitability; it gave employees the incentive to cooperate and do the right thing for the company," "Important to have all employees as stockholders when they join through the incentive stock option plan," "ESOP at time of offering, so employees were able to participate in success of offering; this was a strong help in boosting morale," "ESOP and broad-based profit sharing from top to bottom," "ESOP helped to create feeling that IPO was a culmination of all employees' efforts—employees were motivated to join a common cause for the common good—not management intimidation but rather making them feel like they wanted to be part of the IPO."

Although executives ranked employee rewards as less important than other factors, they did acknowledge the importance of stock participation

TABLE 6
Descriptive Statistics, Correlations, and Reliabilities for Survival and Success Variables[a]

Variables	Mean	s.d.	α	1	2	3	4	5	6
1. Organization-based rewards	3.26	.69	.75						
2. Input	3.28	.88	.80	.30					
3. IPO issues	3.37	.76	.77	.32	.33				
4. Product	3.73	.68	.77	.02	.35	.13			
5. Employees	3.70	.65	.84	.53	.39	.18	.28		
6. Top management	3.89	.61	.64	.03	.02	.70	.11	.02	

[a] Correlations above .30 are significant at the .05 level, and those above .38 are significant at the .01 level. Component items are listed in the Appendix.

programs. Their comments suggest that stock ownership might contribute toward the development of a cohesive workforce whose members can work together through the turbulence of the public offering period. The overall results of this study imply that both investors and management may underrate the significance of organization-based compensation programs. In fact, investors seem to respond negatively to a factor that actually has a positive impact on survival chances.

The population ecology model is particularly useful for the study of small, growing firms, but how it can be applied to larger, established corporations remains an unanswered question. Our definition of inertia indicates that organizations with high inertia can be either "at rest" or "in uniform motion" but that they will move when acted upon by an external force. We know that initial public offering firms are not at rest (the IPO process itself is a significant change) and, therefore, high-inertia IPO firms would appear to be in uniform motion. We cannot make the same assumption for other populations, in particular for large businesses. In fact, research could be designed to establish the point at which inertia becomes harmful, rather than helpful, to organizations.

However, a large firm, whether at rest or in motion, is still less likely to respond to external forces simply because of its size. When it does respond, its size will make a change process more difficult to complete. Large masses, whether at rest or in motion, are more difficult to move than small ones. How does a large firm retain its ability to respond to change? A more comprehensive view of the role of inertia in organizations might imply that large organizations should *not* attempt to sustain inertia at the corporate level because it reduces their ability to transform when change is necessary. However, these firms might still benefit from inertia within their business units (versus at the corporate level). Therefore, the theoretical argument might not be whether inertia is good or bad for large firms, but where inertia should be enhanced (corporate or business-unit level). Human resource policies might be best when supporting high inertia at the division or business-unit level.

If population ecology is a viable perspective for evaluating the ability of human resource management systems to affect corporate performance, it might also suggest a less complex process than that posed by the strategic management literature. According to the work in SHRM, all the components of human resource management (e.g., training, benefits, compensation, selection, and so forth) must be aligned to support one coherent human resource strategy, and this overall strategy should be designed to enhance a corporation's business strategy (Gerhart, Trevor, & Graham, 1995; Jackson et al., 1989; Schuler, 1987). The process of aligning all of the various human resource functional areas is extremely complex. In addition, the human resource department is responsible for design and administration, but management carries out the policies and procedures. This system leaves considerable room for variance in how human resource programs are actually implemented. Given the unreasonableness of coordinating this type of strategic human resource agenda, population ecology might offer a more concise, realistic method for diagnosing the impact of HR programs on organizational performance.

LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

Several limitations of this research study should be taken into consideration when interpreting the findings. First, the sample of IPO companies studied here might not be representative of all firms at this stage. In fact, it could be argued that this particular sample is made up of companies with greater chances of survival because the firms making initial public offerings in 1988 were somewhat affected by the stock market crash of 1987, which made investors more cautious. As mentioned earlier, there is also a possibility of positive bias in the reporting of data in the prospectuses. In addition, the prospectus-coding process—which has been generally referred to as "cruel and unusual punishment" (Marino et al., 1989)—could also have been prone to errors in interpretation, even though we took measures to minimize such problems.

Additional work on the measurement of human resource value needs to be conducted. The prospectuses provided a useful data source; however, their primary audience is the investment community, and prospectuses are the documents that provide information to investors. Therefore, it is possible that some of the human resource information (such as indications of how important employees were to a firm's overall strategy) communicated a message that was not based on actual events. It would be useful to study the degree to which the signal correlates with the actual behavior and how both affect firm performance (in terms of profit, productivity, stock price, sales, etc.).

Research should continue within two domains. The first involves more extensive work in smaller firms like our initial public offering sample, and the second requires testing these hypotheses in larger, more established businesses. Additional research should also consider changes in human resource programs occurring after initial public offerings. This type of research would allow a further test of the population ecology model because certain changes in human resource practices should result in decreased inertia and thus lead to negative impacts on organizational performance. This view is in contrast with the contingency theory perspective, according to which changes made to meet environmental demands and business strategy should improve performance. It would also be useful to track the performance of these companies in order to understand key success factors and events that led to organizational death. In addition, research that investigates the impact of human resource issues prior to an IPO would provide additional evidence of its role during early development stages. If our IPO sample is biased in that it consists of companies that were more likely to succeed than other firms, then the impact of the two human resource variables might actually be understated in this research.

Future studies should ideally contrast the two organizational perspectives (population ecology and contingency theory) in both large and small firms to determine whether early human resource programs and subsequent changes in human resource practices enhance or deter organizational performance and survival. Although the population ecology perspective was supported in this study, it is unclear whether this support is only applicable to smaller, newer organizations such as IPO companies. Kruse (1993), who conducted a study of profit sharing and firm performance, found that profit sharing had a stronger effect on performance in smaller firms (fewer than 775 employees); however, he also found a strong effect in a subgroup of organizations that consisted of the largest organizations (17,000 or more employees). Additional research is needed to determine if firm size and type are important in explaining whether the population ecology or the contingency theory model is more useful for understanding firm performance.

It is possible that inertia-inducing human resource management practices are only important for long-term measures of performance, such as survival. Therefore, additional SHRM research needs to include not only immediate and short-term outcomes, but also long-term measures of performance.

SUMMARY

In this research, we have expanded the field of strategic human resource management by providing an analysis based on population ecology and by studying a sample and a dependent variable that have been neglected in the past. The research also augmented the population ecology literature by contributing toward a better-developed understanding of the role of human capital in the long-term survival of organizations. The findings should be of interest to investors who might want to reconsider their methods of evaluating initial public offerings and to owners of smaller businesses who want to expand their operations. In addition, the results have some implications for large organizations.

In today's environment, middle management jobs are being eliminated, and employees are being told that there is no job security. A new employee contract that features tangential relationships with employers and willingness to leave an organization at a moment's notice is being promoted in the academic and business literatures. If corporations, both large and small, adhere to this advice, it seems that they might be creating a structure with low inertia that could ultimately contribute to poor performance and perhaps their own demise. The role of inertia or structural cohesion within organizations deserves considerable research. In addition, the impact that human resources can have on strengthening and sustaining cohesion should receive more attention.

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APPENDIX
Items Important for Firm Survival and Success

1. *Organization-based employee rewards*—Compensation policy, way employees were rewarded.

2. *Input*—Technical expertise of employees, firm's manufacturing process, business expertise of employees, working long hours.
3. *IPO issues*—Timing of the IPO, IPO market, underwriters.
4. *Product*—Company's ability to be innovative, product differentiation, company's technology, product superiority, characteristics of the product.
5. *Employees*—Commitment to employees, company's approach to employees, way employees worked together, family atmosphere.
6. *Top management*—Leadership skills of top management, board of directors, top management team.

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CONTEXTUAL ANALYSIS OF PERFORMANCE IMPACTS OF OUTCOME-BASED INCENTIVE COMPENSATION

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This study investigated how contingency factors such as competitive intensity, customer profile, and behavior-based control influenced the effectiveness of an outcome-based incentive plan supporting a customer-focused service strategy. Empirical analyses were based on data for 77 months from 34 outlets of a major retailer, 15 of which implemented the incentive plan. Results support theoretical predictions: the positive impact of outcome-based incentives on sales, customer satisfaction, and profit increased with intensity of competition and proportion of upscale customers and decreased with level of supervisory monitoring.

Outcome-based compensation is increasingly being used by many firms in service industries. A major reason for this change is the intensifying competition that is motivating firms to emphasize customer-focused service as a way to gain a strategic advantage. Customer focus involves understanding and satisfying individual needs, which may differ widely across customers. Therefore, the tasks performed by the workers who deliver customer-focused service are more difficult to prescribe and less programmable than the tasks required for a more conventional, mass-production-style service. Thus, the increased use of outcome-based compensation is consistent with organizational control theory, which suggests that outcome-based control is appropriate in an environment characterized by low task programmability. However, anecdotal evidence indicates that the effect of outcome-based compensation on organizational performance has not been uniform across organizations providing customer-focused service and that, in fact, some have reverted to behavior-based control systems. We posit that certain environments do not warrant the adoption of a customer-focused strategy coupled with outcome-based control. Specifically, customer focus is less effective when customers are not particularly discerning or demanding of high levels of service; in such circumstances, implementing outcome-based incentives is less likely to improve organizational performance. We examined how this fit between contingency factors, customer service strategy, and organizational control system affects organizational performance using a panel of data for 77 months from 34 outlets of a retail firm, of which only 15 outlets implemented an outcome-based incentive plan.

Until recently, many service industries were sheltered from competition by regulatory constraints. There was little competition from overseas. Today, increasing competition is creating incentives to drive out inefficiencies (Roach, 1991) and to improve service quality (Zeithaml, Parasuraman, & Berry, 1993). In a recent Ernst & Young survey, executives ranked the improvement of customer service as the single most critical challenge facing U.S. business (Clark, 1993). To motivate employees to enhance customer satisfaction, many service organizations have recently moved from traditional behavior-based fixed salaries to outcome-based contingent compensation (Bivins, 1989; Burns, 1992; Coopers & Lybrand, 1992; *Discount Store News,* 1993; Kanter, 1989; *Restaurants and Institutions,* 1992; Sawyers, 1993; Schlesinger & Heskett, 1991b). There is also increased use of customer satisfaction measures as a basis for such outcome-based compensation (Hauser, Simester, & Wernerfelt, 1994).

The increased emphasis on customer-focused service requires that the needs and expectations of individual customers be understood and satisfied. But if service providers need to strive to determine the needs and expectations of customers, the exact tasks they must perform cannot be prespecified. For instance, Pfeffer reported that "rule #1" at Nordstrom, a retailer renowned for its superlative customer service, was "Use your good judgment in all situations. There will be no additional rules" (1994: 41–42). Thus, in such cases, service providers' jobs become less programmable and more ambiguous, qualities that in turn make it difficult to monitor the providers' behavior.

Two different approaches have been discussed in the literature on organizational control: Behavior-based control involves high levels of supervisory monitoring, direction of and intervention in activities, and subjective, complex methods of evaluating performance that are typically focused on employees' job inputs. In contrast, outcome-based control involves relatively little managerial supervision of employees, reliance on straightforward, objective measures of performance, and use of compensation schemes that are based on these outcome measures (Anderson & Oliver, 1987). Since measures of output such as sales and customer satisfaction are often available as a basis for determining the rewards of service providers, organizational control theory predicts the use of outcome-based control to support a customer-focused service strategy (Eisenhardt, 1988).

A vital ingredient of excellent service quality is hiring highly motivated employees and rewarding their superior performance (Zeithaml et al., 1993). Many service firms are now trying to enhance customer satisfaction by focusing on the activities of front line workers and linking their compensation—and not simply that of senior executives—to performance (Schlesinger & Heskett, 1991b). Articles addressing practitioners have also recognized that it is necessary to motivate service providers by linking rewards to performance in order to improve customer service in the short term and thus increase sales and profitability in the long term (Funston 1992; Kochan & Osterman, 1994; McCallum & Thompson, 1993).

Outcome-based compensation can range from individual bonus plans and individual merit pay to plans based on group performance, such as profit sharing and gain sharing. Prior empirical studies of the performance impacts of outcome-based compensation have yielded mixed results (Gerhart & Milkovich, 1992). Few studies have examined individual bonus plans, especially at lower levels of organizations; most have found a positive average impact (Kahn & Sherer, 1990; Locke, Feren, McCaleb, Shaw, Denny, 1980; Taylor, 1967). Analyzing quarterly sales data from the same research site used for the current study, Banker, Lee, and Potter (1996) reported that store sales increased on the average after the implementation of the incentive plan and that the positive impact on sales increased over time.[1]

In contrast, two studies of merit pay (Kahn & Sherer, 1990; Pearce, Stevenson, & Perry, 1985) detected no improvement in organizational performance although methodological concerns may limit the interpretability of the second study (Gerhart & Milkovich, 1992). Studies on profit sharing (Weitzman & Kruse, 1990) and gain sharing (Kaufman, 1992; Schuster, 1983), however, have generally shown positive impacts on productivity. Although many firms are currently implementing outcome-based compensation plans, some firms have reverted to behavior-based control systems (*Financial Times,* 1994; *Wall Street Journal,* 1990; *Women's Wear Daily,* 1991). Contingency theory suggests that the impact of a compensation system on organizational performance depends on the fit between the organizational context and the system chosen. It is important, therefore, to evalute the effectiveness of pay-for-performance systems taking into account contingency factors such as business strategy, competitive environment, employee characteristics, and existing human resource systems (Gerhart, Minkoff, & Olsen, 1994).

Although outcome-based control fits the task ambiguity created by a customer-focused service strategy, such a service strategy may not fit an organization's environment. In the absence of a fit, outcome-based control will not be effective. Therefore, we identified the competitive and market conditions that are necessary for the success of a customer-focused service strategy. In addition, to the extent that effective behavior-based control is already in place, the potential for improving performance by implementing an incentive plan is limited. In this research, we empirically evaluated whether all of these factors moderated the impact of an outcome-based incentive plan supporting a customer-focused service strategy on three measures of performance in the specific setting of the retail industry. Our research site offered a unique set of experimental and control stores, a long time series of data, and a setting in which the major organizational change was the implementation of the outcome-based incentive plan. These features enabled us to evaluate the extent to which performance gains after the implementation of outcome-based compensation were related to the competitive and market environment of a store and the degree of behavior-based control in place prior to the implementation of the plan.

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[1] This initial study did not include performance measures other than sales and did not explain cross-sectional differences between stores in the impact of the incentive plan. The present study shows that the effectiveness of the plan in individual stores, as measured by sales, customer satisfaction, and profit, is moderated by the contextual factors of competitive intensity, upscale customers, and supervisory monitoring that are suggested by strategic contingency theory.

THEORETICAL BACKGROUND AND HYPOTHESES

The Impact of Outcome-Based Incentives

Increased competition has led many companies to emphasize customer-focused service in order to enhance customer satisfaction and gain a competitive advantage (Schlesinger & Heskett, 1991b). This is especially true of service organizations because in such businesses product differentiation is low, customer interaction is high, and the production and consumption of services are inseparable (Zeithaml et al., 1993). Customer focus can reveal opportunities for creation of buyer value and also allow a seller to command price premiums through value-based pricing (Forbis & Mehta, 1981). Retaining old customers and winning new customers is necessary for maintaining or improving market share and profitability. In a study of customer switching behavior in restaurants, hotels, banking, airlines, and retail industries, Keaveney (1995) identified dissatisfaction with service encounters, service mistakes, unsatisfactory employee responses to mistakes, and attraction by competitors offering superior service as some of the primary reasons for customer switching. In the short run, delivery of high-quality service provides an opportunity for companies to shield themselves from price competition (Fornell, 1992; Garvin, 1988). In the long run, superior customer service leads to both market expansion and gains in market share (Fornell, 1992; Zeithaml et al., 1993).

Customer-focused service changes the nature of the tasks service providers perform. Workers involved in customer service need to be empowered because the exact tasks required to improve customer satisfaction cannot be prespecified, as different customers have different needs, and their service expectations often differ from those of the management (Schlesinger & Heskett, 1991a). Zeithaml, Parasuraman, and Berry (1993) offered three reasons for worker empowerment in service organizations. First, services are basically intangible. Because customer service produces performances and experiences rather than objects, precise production specifications concerning uniform quality can rarely be set. Often, the criteria customers use to evaluate customer service are complex and difficult to capture precisely. Second, services are heterogeneous. The delivery of customer service varies from customer to customer and from day to day unless a service organization chooses a very narrowly focused market niche. The quality of the interactions bank tellers, flight attendants, retail sales consultants, and insurance agents have with customers can rarely be standardized to ensure uniformity in the way the quality of goods produced in a manufacturing plant can. For example, the duties of a bank teller range from processing simple deposits to explaining legal problems associated with cashing a postdated check. Zeithaml and colleagues (1993) reported a case in which failure to explain legal problems resulted in the customer's switching to another bank. Understanding the special service needs of each customer is thus essential, and hence these tasks are not easily programmable. Third, the production and consumption of many services are inseparable. The quality of service is often determined by service delivery, usually in an interaction between customer and provider, rather than engineered at a manufacturing plant and delivered intact to the customer. Thus, when the emphasis is on customer-focused service, the tasks performed by a service provider are more ambiguous and less programmable, necessitating the empowerment of employees.

Research on organizational control that relates task programmability to outcome- or behavior-based control (Anderson & Oliver, 1987; Eisenhardt 1985, 1988; Ouchi, 1979) provides a useful framework in this case. Earlier studies have suggested that outcome-based control is likely to result in higher performance when outcome measurability is high and task programmability is low (Conlon & Parks, 1990; Eisenhardt, 1985; Govindarajan & Fisher, 1990; Snell, 1992). Since customer-focused service involves greater worker empowerment and task ambiguity, an outcome-based control is necessary to implement this strategy.

A customer-focused service strategy may not, however, be consistent with an organization's competitive and market environment. Contingency theory, in general, is based on the common proposition that organizational performance is a consequence of the fit between two or more factors, such as an organization's environment, strategy, structure, systems, style, and culture (Pfeffer, 1982). Because of inertia, inflexibility, resource immobility, and related issues, organizations cannot always assure a perfect fit between all these factors. Therefore, empirically, researchers have found different levels of organizational performance, with performance level related to degree of fit (Van de Ven & Drazin, 1985). Although outcome-based compensation fits the customer-focused strategy characterized by low task programmability well, the performance impact of implementing an outcome-based compensation plan in such a case will depend on the extent of the fit between the customer-focused strategy and an organization's competitive and market environment.

The Moderating Effect of Contextual Factors

Researchers have recognized that the effectiveness of outcome-based compensation may depend on other contingency factors (e.g., Gerhart et al., 1994). For instance, Gerhart and Milkovich (1992) stated the following:

> [F]urther development and testing of contingency models is needed. Contingency factors may include not only other human resource activities but also employee, job, organization, and external factors. The effectiveness of compensation policies may vary significantly across settings that differ on these contingency factors. It is critical for both theory and practice that such factors be identified and understood more completely. . . .
>
> No pay program (or set of pay programs) is likely to be equally effective under all sets of conditions. Therefore, looking only at the average effect of a pay program across diverse settings overlooks the possibility that there is a statistical interaction between pay programs and contextual (i.e., contingency) factors. This can also be described as a question of *fit*. Some pay programs and organizational strategies are likely to be more congruent than others. . . . The contingency approach suggests the need for organizations to decide what pay programs fit best with their overall strategy (1992: 482).

When an outcome-based compensation plan is implemented to support a customer-focused service strategy, factors that affect the relation between customer service level and customer buying decisions are the most salient. Specifically, the existence of competing organizations that can fill customers' needs and economic and demographic factors that influence customers' service outlet choices are especially relevant. In addition, the impact of outcome-based control will be affected by the level of behavior-based control in place before a new incentive plan is implemented.

The moderating effect of competition. Intense competition has been identified as a principal reason for service organizations' choosing customer-focused service as a strategy for gaining competitive advantage (Schlesinger & Heskett, 1991b). Studies in marketing also identify competitor concentration as a principal moderator of the impact of customer-oriented strategies on performance (Slater & Narver, 1994). The greater the competition, the more aggressive a business must be in discovering customer wants and creating superior customer value to satisfy them (Kohli & Jaworski, 1990). Service industries such as retail stores, banks, airlines, insurance brokerages, restaurants, and hotels are characterized by monopolistic competition involving service outlets located near each other in a given geographic area, with each competing for its clientele (Kreps, 1990). Service units differentiate themselves from one another through different levels of customer service. If a service unit located in a highly competitive geographical area offers a low level of customer service, it risks customers' "walking away" to a nearby competitor. Conversely, a service organization enhancing the level of its customer service stands to win customers away from its competitors. Attraction by competitors offering better service is a principal determinant of customer switching behavior (Keaveney, 1995). In contrast, a service organization facing little competition or enjoying monopoly power is less likely to gain from higher levels of service because the behavior of the customers is less likely to be influenced by the behavior of the service providers. Therefore, although competitive intensity is negatively related to sales, the positive impact of implementing an outcome-based incentive plan to provide superior customer service and win and retain customers is likely to be more perceptible in a more intensely competitive environment. Accordingly,

> *Hypothesis 1: The greater the intensity of competition, the greater the performance impact of an outcome-based incentive plan implemented to support a customer-focused service strategy.*

The moderating effect of customer profile. Stores in upscale markets are likely to enjoy greater sales. But, in addition, the effectiveness of enhanced customer service depends on the extent to which customers value service quality relative to other factors influencing their buying behavior. Studies of department stores indicate that upscale customers value customer service and are attracted by enhanced customer service more than other customers (Crask & Reynolds, 1978; Korgaonkar, 1981; Peterson, Albaum, & Ridgway, 1989). Because upscale buyers exhibit more discretionary purchasing behavior, their buying decisions are more likely to be affected by the improved customer service resulting from the implementation of an outcome-based incentive plan (Slater & Narver, 1994).

Following Korgaonkar (1981) and Crask and Reynolds (1978), we measured the construct of upscale customers in terms of income, age, college education, and employment characteristics. Customers with high household incomes are likely to have more flexibility in buying decisions and hence are more likely than others to be influenced by customer service and not just by prices. Older households are wealthier and more willing to spend (Petre, 1986) and have substantial discretionary income (Allan, 1981). Better-educated customers tend to demand better product information and higher service quality and to expect service providers to meet their needs. Upscale customers are less likely to compromise their specific needs for a lower price. The buying decisions of customers who value customer service more are more likely to be affected by enhanced customer service. Therefore,

> *Hypothesis 2: The more upscale the market, the greater the performance impact of an outcome-based incentive plan implemented to support a customer-focused service strategy.*

The moderating effect of monitoring. Performance improves with the extent of behavior-based control, but studies by Eisenhardt (1985) and Conlon and Parks (1990) have indicated that behavior- and outcome-based controls can substitute for one another. Agency theory also suggests that if an agent's actions can be observed more precisely, desired actions can be induced with lower risk premium costs. For service outlets that rely on a high level of monitoring by supervisors and managers, a switch to outcome-based compensation will not produce a dramatic increase in performance, because the high level of monitoring that existed prior to the change, although not perfect, will have already produced better performance than that realized by service outlets with little monitoring. Thus, the gains in organizational performance from the implementation of an outcome-based compensation plan vary inversely with the extent to which behavior-based control is in place at the time of the plan's implementation. Therefore,

> *Hypothesis 3: The higher the existing level of monitoring, the smaller the performance impact of an outcome-based incentive plan.*

METHODS

Research Site

Our research site was a large retailer whose stated strategy was to provide customers with exceptional value. It operated full-line department stores emphasizing fashion leadership, quality merchandise, broad selections, and superior customer service. All the retail outlets (stores) sold a full line of similar merchandise to the general public. An average store occupied approximately 220,000 square feet and employed about 180 sales consultants. Although the stores were spread over a large geographic area, most of the stores were located in or near shopping malls in urban areas.

Retail industry. Competition in the retail industry has become very intense in recent years. *Forbes* (Koselka, 1991) reported a 36 percent increase in retail square footage in the 1980s but observed that the increased competition had led to a sharp decline of 16 percent in sales per square foot. In this competitive environment, increasing or at least maintaining productivity has become a necessity, and retailers have resorted to emphasizing high-quality service delivery as a competitive strategy designed to attract and retain customers. As a *New York Times* article (Stevenson, 1989) reported, "After years of concentrating on keeping costs low and luring customers with constant rounds of sale prices, the large department and apparel stores increasingly see competent service from an efficient, cheerful sales staff as the key to success in an increasingly competitive retailing environment." Many large retailers, including Nordstrom, Bloomingdale's, Macy's, Rich's, and Carter Hawley Hale, have implemented or expanded their incentive pay plans (Barmash, 1989; *Discount Store News,* 1993; Ginsberg, 1989; Lloyd, 1989). An Ernst & Young survey of the retail industry (Bivins, 1989) reported that virtually all department stores offered incentive plans such as commissions, base salary plus commission, and quota bonus plans. Newspaper and magazine articles also cite firms reporting dramatic improvements in performance when outcome-based plans are implemented (e.g., Ginsberg, 1989).

Incentive plan. The job description for sales consultants at our research site before the implementation of the incentive plan involved routine duties such as being available, dressing appropriately, closing sales, restocking merchandise, and billing. Although these duties continued to be a part of a sales consultant's job, a customer-focused service strategy requires the salesperson to "go the extra mile" to satisfy the needs of customers. Sales consultants could enhance customer service by keeping databases of customers and their preferences, making calls to update them on new products, informing them of sales and special events, and retrieving merchandise they need from other departments or stores. In addition, sales consultants were empowered to take necessary steps to satisfy customers by providng discretionary discounts and unconditionally accepting returns. These activities required knowledge of the specific needs of individual customers and were difficult to prescribe a priori, so task programmability decreased.[2]

Following other retailers, managers at our research site introduced the outcome-based incentive plan to provide service "beyond customers' expectations." Documents distributed to salespersons describing the plan also emphasized enhanced customer service as its objective. Outcome-based incentives were expected to lead to superior customer service and thus to improved customer satisfaction and sales performance. The structure of the incentive plan was the same at all stores in which it was implemented; it applied to all sales consultants and to all merchandise sold at those stores.

The outcome-based incentive plan implemented at our research site is best described as a bonus program. A salesperson was paid a base wage equaling an hourly rate times the hours worked plus a cash bonus if the quarterly sales he or she generated exceeded a prespecified goal. (The hourly wage rate was the same as that in place before the plan was implemented and was comparable to the wage rate at the 19 stores that did not implement the plan.) Each employee's sales goal was based on his or her hourly wage rate, merchandise category, and other proprietary factors. The cash bonus equaled a prespecified percentage rate times the amount by which the sales goal was exceeded. Failure to meet the quarterly sales goal resulted only in no bonus payment, with the base pay guaranteed. However, failure to meet the target in two successive quarters could result in termination of employment.[3] Bonus payment was substantial relative to salary, averaging 23.5 percent of the annual base salary of about $16,000. In addition, because these employees had little opportunity for career advancement or other outcome-based rewards within the firm, this setting was particularly suitable for examining the impact of incentives on performance.

After the plan's implementation, managers became responsible for supporting the consultants' enhanced customer service activities, and the former became largely facilitators as the sales consultants gained autonomy. After outcome-based compensation was introduced, the managers were encouraged to spend their time scheduling salespeople, resolving disputes over credit for sales, and instructing employees who had subpar selling performance, in addition to carrying out the supervisory and monitoring activities they had performed earlier. Under the incentive plan, sales department managers and supervisors were also paid a quarterly bonus as a percentage of the amount by which actual sales exceeded their goals, so the new compensation plan covered all store personnel directly responsible for customer service.

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[2] We observed that the time sales consultants spent with customers, the time spent in explaining product choices to customers, and the training of sales consultants by headquarters staff for customer-focused service tasks all increased after plan implementation. Thus, in terms of Eisenhardt's (1988) operational definition, task programmability decreased with the new emphasis on a customer-focused service strategy.

[3] Since the incentive plan was an add-on program guaranteeing sales consultants the same base salary they had earned prior to plan implementation, the compensation of the sales consultants who continued to be employed at our research site increased. However, possible termination for failure to meet the quota accentuated the steepness of pay as a function of performance. Thus, as the efficiency wage hypothesis suggests, both the level and the form of this incentive plan motivated sales consultants to improve their performance. Unfortunately, since all stores had the same plan structure, it was not possible to separate the impact of these two aspects.

Plan implementation. Our research site comprised 34 stores located in a relatively homogeneous geographic region spanning six states. Conversion of 15 of these 34 stores to the outcome-based incentive plan occurred over a period of about three years as company managers were unsure about the precise extent of the impact of the plan on store performance. Implementation of the plan coincided with an emphasis on customer-focused service. The plan was first implemented toward the end of 1987 in one store chosen from a group of similar stores. Three additional stores implemented the plan in 1988, and another seven stores were added in 1989. By the end of 1990, four more stores had implemented the plan. Plan implementation was preceded by a number of question-and-answer sessions and store visits by corporate staff members, both designed to aid the transition. Corporate staff was present on site during the initial phases of implementation to emphasize customer-focused service and explain the details of the plan to store employees. Sequential implementation of the plan was necessitated by the limited number of headquarters staff members and by the desire of the management to assess performance impact before full-scale adoption. The 19 stores that did not implement the plan provided a natural control group that enabled us to assess the cross-sectional effects of the implementation of the incentive plan on store sales, customer satisfaction, and profitability for the 15 experimental stores.

Interviews with senior managers in finance, human resources, and stores (sales) departments involved in the design and implementation of the plan and detailed examination of internal correspondence assured us that the 15 stores were chosen for initial implementation only because they were generally representative of other stores. Table 1 compares the 15 experimental stores and the 19 control stores on the levels of several variables of interest existing before the implementation of the plan. We disguised all numbers by multiplying by a constant. The median number of square feet of retail area is identical for the control and experimental stores, and the difference in means is also statistically insignificant. The 15 experimental stores had slightly higher sales than the 19 control stores, and they also had slightly greater competitive intensity and more upscale customers. However, none of these nor any other variable appearing in the table exhibits any statistically significant or systematic differences between the experimental and control

TABLE 1
Comparison of Control Stores with Experimental Stores[a]

	Stores with Plan		Stores without Plan		Statistical Tests
Variables	Mean	Median	Mean	Median	of Differences[b]
Square feet	227,520	187,000	220,420	187,000	$p(t) = .88$ $p(z) = .66$
Sales 1987[c]	$43.02	$35.08	$34.46	$22.90	$p(t) = .30$ $p(z) = .22$
Competition	36.47	35	31.58	34	$p(t) = .36$ $p(z) = .46$
Upscale customer profile	0.47	0.66	−0.37	−1.01	$p(t) = .14$ $p(z) = .15$
Monitoring 1987	0.22	0.21	0.23	0.21	$p(t) = .72$ $p(z) = .73$
Customer satisfaction index	58.05	57.33	57.82	57.52	$p(t) = .92$ $p(z) = .84$
Profit 1987	0.270	0.297	0.267	0.291	$p(t) = .76$ $p(z) = .42$
Number of stores	15		19		

[a] All numbers have been disguised by multiplication by a constant.

[b] $p(t)$ is the probability that the means of the two groups are equal; $p(z)$ is the probability that the medians of the two groups are equal.

[c] Expressed in millions of dollars.

stores. This finding is consistent with management's intent to select representative stores for initial implementation.

Data Collection

Sales and profit data were collected from the company's general financial ledgers, and employee data were obtained from databases maintained at its headquarters by the accounting and human resources management staffs. We cross-checked these data with aggregate statements to identify and eliminate data entry errors. The company's marketing and sales research group provided results of customer surveys and data on competition and customer demographics.

Measures of performance. Outcome-based incentive plans are expected to have both short- and long-term effects on organizational performance. The short-term effect on performance results from improved customer service, which translates into an immediate increase in sales (Anderson et al., 1994; Hauser et al., 1994).[4] An increase in sales also results in an increase in profit in the short term if increases in all expenses including bonus payments are less than the increases in sales. In addition, improved customer service leads to increased customer satisfaction, which in the long term leads to repeat purchases by the same customers (Anderson & Sullivan, 1993; Anderson, Fornell, & Lehmann, 1994; Hauser et al., 1994; Zeithaml et al., 1993). Therefore, we used three measures of organizational performance. Two assessed short-term performance gains: a monthly time series of data on stores sales over 77 months and profitability per square foot over 65 months. To measure long-term performance impact, we used a seven-year time series of data on customer satisfaction.

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[4] Although the above statement is intuitive, the following statement from Stanley Marcus, the retired chairman of Neiman-Marcus, underscores the importance of customer service in generating sales in the retail industry. Marcus admonished specialty and department store retailers for forgetting their sales-service heritage and remarked "Poor selling saved me $48,873 in 1983. That year I decided I would not buy anything I didn't need unless someone sold it to me. Whenever I found something I wanted, but didn't encounter sales persuasiveness, I did not buy. By the end of the year my savings total was $48,373" (Zeithaml et al., 1993: 3).

Sales, which we measured as average monthly sales per square foot, is a commonly used performance measure in published research (Weitz, 1981) and is also widely used in practice (Peck, 1982). This performance measure can also be easily attributed to the individual responsible for it (Anderson & Oliver, 1987). Profitability is also a widely used measure of performance (Behrman & Perreault, 1982) that supplements sales information because it reveals if sales have been increased by cutting margins (Anderson & Oliver, 1987). We measured store *profit* as store sales revenues less the cost of goods sold and all store-level expenses, including the salaries and bonuses of sales consultants and managers and such support expenses as security, displays, promotions, and administration. Customer satisfaction is a key measure available in the short term that is a leading indicator of long-term performance (Griffin & Hauser, 1993; Hauser et al., 1994; Phillips, Donkin, Treece, & Hammonds, 1990), especially in the retail industry, where repeat business is very important. Our *customer satisfaction index* (CSI) is based on customer surveys conducted every year by an independent market research agency. We constructed an annual measure of customers' satisfaction with salesforce service for each store by averaging the responses of customers to four survey questions, presented in the Appendix. We chose these four questions because they were identified by the company's customers as important. Principal components analysis indicated that more than 87 percent of the variation in responses could be explained by one eigenvalue. The alpha coefficient is .92, much higher than the conventional .70 level (Nunnally, 1978).

Measures of contextual factors. The sales research group at our research site supplied us the number and type of competitors in the trade area of each of the 34 stores. With this information we constructed a measure of the intensity of the *competition* faced by each retail store. Managers at our research site classified competitors into one of three categories: high-end, middle, and low-end. As noted, the firm we examined in this research study positioned itself as a high-end retailer offering premium-quality products and superior customer service. Thus, other high-end retailers were its closest competitors as they sold a similar range and quality of products and provided a high level of customer service; these included retailers such as Saks Fifth Avenue, Neiman Marcus, Macy's, Bloomingdale's, and Nordstrom. Low-end competitors included discount retailers, such as Target, Montgomery Ward's, Kmart, Wal-Mart, and Kohl's, whose marketing strategy was based on low prices rather than on premium service and quality. Middle-range competitors included stores such as Sears, Mervyn's, and J.C. Penney, which were between the two extremes. The competition measure was a weighted index of the number of competitors (classified into three categories based on market niche) multiplied by the weights 3, 2, and 1 (high-end = 3, middle = 2, low-end = 1) for the three categories. These weights were based on the company's practice, which reflected the fact that competition from the low end did not affect its performance as much as competition from the high end.[5] Therefore, the overall competition index weighs the impact of the close competitors (in the same high-end category as our research site) much more than the impact of discount stores. Stores with a higher value on competition were located in more intensely competitive areas.

We combined four demographic variables into a principal component labeled *upscale customer profile.* These four variables (shown with corresponding factor loadings in parentheses) were measured for the trading area of each store: median household income (0.445), median age (0.334), percentage of the population with college education (0.439), and percentage of white-collar workers in the population (0.537). Unidimensionality was found as only one principal component emerged with an eigenvalue greater than one. The weights for the principal component indicate that an upscale store's trade area had a higher median household income, an older population, and larger percentages of both college-educated and white-collar individuals.

A behavior-based control in place at all stores prior to the implementation of outcome-based compensation, which continued to be used even after the implementation, was sales managers' supervision and monitoring of sales consultants' efforts. Therefore, we measured supervisory monitoring as the ratio of the number of managers supervising the salesforce to the number of sales consultants at each store. The variable we use in our estimation model, *monitoring 1987,* is the level of supervisory monitoring existing prior to plan implementation, computed as the average monthly ratio for 1987, the year prior to the implementation of the incentive plan.

Descriptive Statistics

Table 2 presents descriptive statistics and correlations for all dependent and independent variables in the estimation models described in the next section. Average monthly sales per square foot are $16.29, with a standard deviation of $8.07.. The average annual customer satifaction index is 63.39 out of a possible maximum of 100. There is a negative correlation between sales and the customer satisfaction index and also between profitability and customer satisfaction, and which suggests that moderators need to be identi-

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[5] Our results are robust, remaining consistent with a variety of alternative weights that maintain this monotonic order (Slater & Narver, 1994).

TABLE 2
Descriptive Statistics and Correlations[a]

Variables	Mean	s.d.	1	2	3	4	5	6
1. Sales	$16.29	$8.07						
2. Customer satisfaction index[b]	63.39	6.04	−.19*					
3. Profit	$4.57	$2.93	.94*	−.30*				
4. Plan	0.20	0.40	.22*	.30*	.16*			
5. Competition	33.73	15.13	.03*	−.22*	.17*	.10*		
6. Upscale customer profile	0.00	1.61	.28*	−.31*	.48*	.22*	−.01*	
7. Monitoring 1987	0.23	0.08	−.16*	.48*	−.46*	−.11*	−.48*	−.37

[a] $N = 2{,}618$. Significance levels should be interpreted with caution because monitoring 1987, upscale customer profile, and competition are constant over time for each store.

[b] Correlations with customer satisfaction index are based on aggregated annual numbers.

*$p < .05$

fied to explain the relations between these performance measures.[6] With respect to the independent variables, the mean of 0.23 for monitoring 1987 indicates that on the average there was about one supervisor for every five sales consultants in 1987. The mean for upscale customer profile is zero by construction. Sales and profit are positively related to customer profile and competition and are negatively related to monitoring 1987. The customer satisfaction index, however, is negatively related to customer profile and competition but positively related to monitoring 1987. Pairwise correlations among the three independent variables reveal that they are negatively related to each other. A dummy variable plan equals 1 if a store is under the incentive plan and 0 otherwise. This variable is positively associated with all three performance measures.

On the average, monthly store sales per square foot increased by $4.50 between 1987 and 1991 for the 15 experimental stores but by only $1.87 for the 19 control stores. However, there was considerable variation in the increase in sales per square foot among the 15 experimental stores. The increase was less than $1.87 for three of the 15 experimental stores but was greater than $9 for two stores and greater than $6 for four more stores. Similarly, the change in monthly profit per square foot from 1987 to 1991 exhibits variation from a low of −$0.16 to a high of $2.56. The increase in customer satisfaction from 1987 to 1991 also shows considerable variation, ranging between 8.85 and 13.52. What contextual factors moderate this differential impact of the incentive plan on store performance, therefore, is an important question addressed in this study.

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[6] Note, however, that the correlation between the change in sales and the change in the customer satisfaction index is positive (.33), as is that between the change in profit and the change in customer satisfaction (.19).

Figure 1 displays a plot of the average sales residuals (scaled by expected sales) for the experimental and control stores before and after the implementation of the incentive plan. We computed the residuals for each store as prediction errors from the following model: $SALES_{im} = \alpha_i + \beta_i AVGSAL_m + e_{im}$, where $SALES_{im}$ is sales per square foot for store i in month m and $AVGSAL_m$ is average sales per square foot in month m over all 34 stores. The parameters α_i and β_i are estimated using all monthly available data prior to the implementation date of the plan. The graph for the experimental stores is centered around the actual date of plan implementation for each store, and the graph for the control stores is centered around the 24th month from the end of our study period, when 13 of the 15 experimental stores had implemented the plan. The two graphs reveal no systematic differences in the sales residuals of the experimental and control stores before plan implementation but do reveal a steep increase in sales residuals after the month of plan implementation for the experimental stores, suggesting that on the average, the incentive plan had a positive impact on sales.

Figures 2, 3, and 4 focus on the experimental stores only. Each figure shows graphs of sales residuals for two subgroups of experimental stores, formed in each case by classifying the 15 experimental stores as either low or high on the basis of one of the three contextual variables. The graphs suggest that although the incentive plan had a positive impact on sales on the average, the impact on individual store sales varied with the contextual factors. Figure 2 shows that stores located in areas in which competition was high experienced a higher increase in sales than stores in low-competition areas, especially about a year after plan implementation. Figures 3 and 4 indicate even sharper differences between the two subgroups when the experimental stores are classified on the basis of upscale customer profile and monitoring 1987, in directions consistent with our hypotheses. In fact, the residuals show a steady decline for the stores classified as low on competition or upscale customer profile or as high on monitoring 1987, and the residuals are negative toward the end of the second year after implementation in these cases. This pattern suggests that although the incentive plan had an initially positive impact on the sales of such stores, these gains dissipated over time because of a lack of fit between the customer-focused strategy and the contextual factors. Similar, but less sharp, patterns are observed for the plots of the residuals of profit and customer satisfaction. Readers are cautioned, however, that these graphs focus on the variation in only one contextual factor at a time, omitting other relevant factors. We estimated the multiple regression models described in the next section to simultaneously take into account variation in all three contextual factors.

If monitoring (behavior-based control) and performance incentives (outcome-based control) can substitute for each other as methods of organizational control (Eisenhardt, 1985), then monitoring level should have decreased after the implementation of the incentive plan. This appears to be

FIGURE 1
Incremental Sales, Control and Experimental Stores

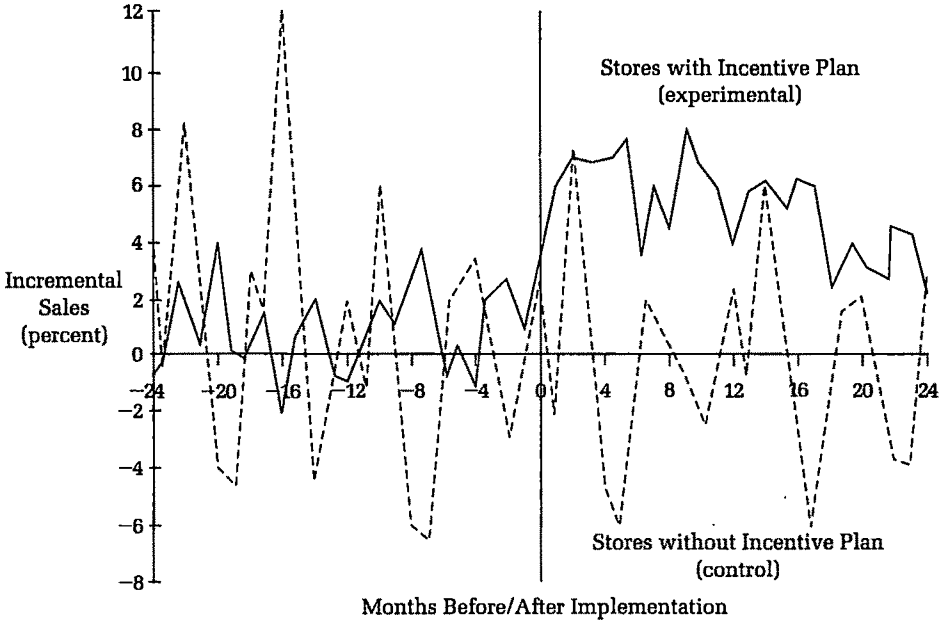


FIGURE 2
Incremental Sales, High- and Low-Competition Experimental Stores

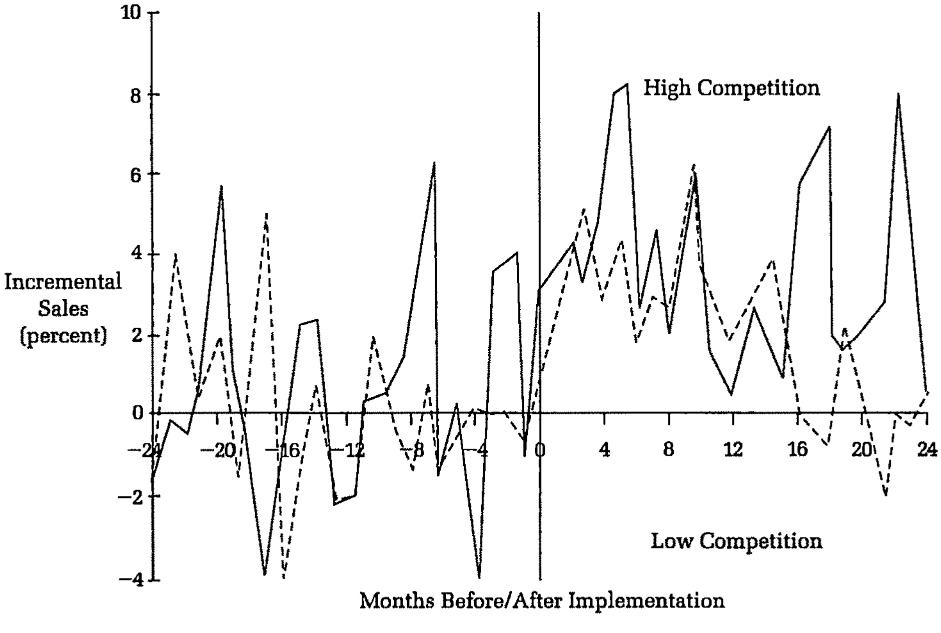


FIGURE 3
Incremental Sales, Experimental Stores with High and Low Upscale Customer Profi

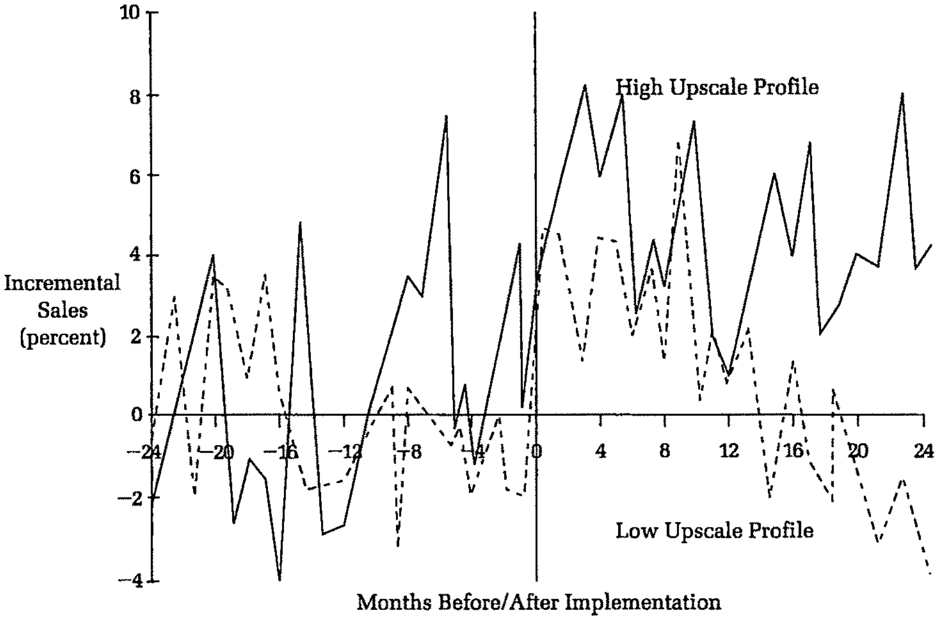
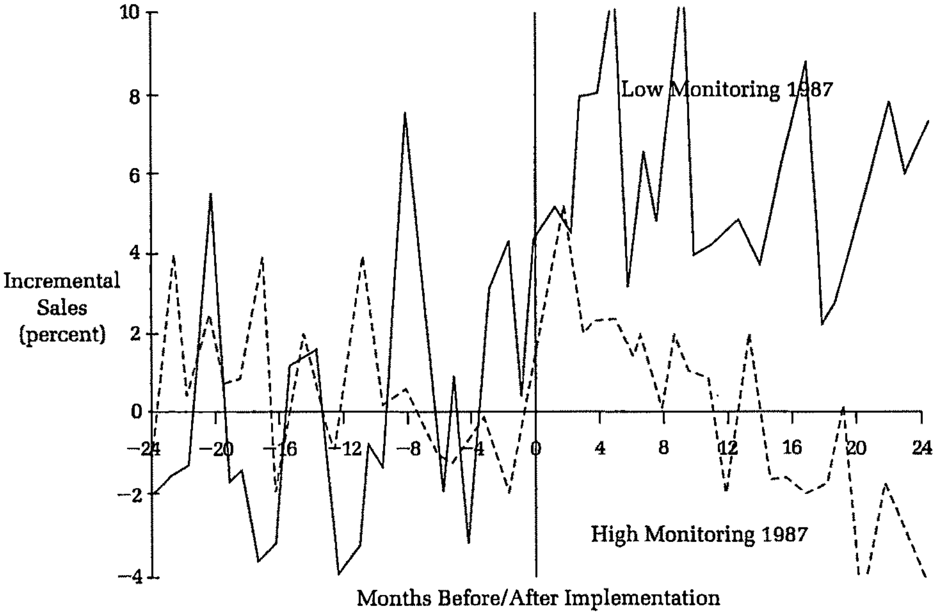


FIGURE 4
Incremental Sales, Experimental Stores with High and Low Monitoring 1987



the case, because values for our measure of supervisory monitoring decrease from an average of 0.223 in 1987 to 0.166 in 1991 for the 15 experimental stores but decrease only slightly from 0.233 in 1987 to 0.211 in 1991 for the 19 control stores.[7] The decline in supervisory monitoring after plan implementation reinforces our results in that it was the new incentive plan, and not an increase in supervision, that was in fact responsible for the improvement in performance.

ESTIMATION MODELS

Moderating Effect of Contextual Factors

Empirical testing of the hypotheses derived earlier involved assessing the impact of the incentive plan on store sales, customer satisfaction, and profit. To estimate the differences in the effectiveness of the outcome-based incentive plan across stores, we estimated the following three models:

$$\begin{aligned} SALES_{im} = {} & \alpha_o^s + \sum_{i=1}^{34} \alpha_i^s D_i AVGSAL_m + \beta_1^s COMPETITION_i + \beta_2^s UPSCALE_i \\ & + \beta_3^s MONITOR87_i + \gamma_o^s PLAN_{im} + \gamma_1^s PLAN_{im} * COMPETITION_i \\ & + \gamma_2^s PLAN_{im} * UPSCALE_i + \gamma_3^s PLAN_{im} * MONITOR87_i + \varepsilon_{im}^s, \end{aligned} \tag{1}$$

$$\begin{aligned} CSI_{iy} = {} & \alpha_0^c + \sum_{i=1}^{34} \alpha_i^c D_i AVGCSI_y + \beta_1^c COMPETITION_i + \beta_2^c UPSCALE_i \\ & + \beta_3^c MONITOR87_i + \gamma_o^c PLAN_{iy} + \gamma_1^c PLAN_{iy} * COMPETITION_i \\ & + \gamma_2^c PLAN_{iy} * UPSCALE_i + \gamma_3^c PLAN_{iy} * MONITOR87_i + \varepsilon_{iy}^c, \end{aligned} \tag{2}$$

and

$$\begin{aligned} PROFIT_{im} = {} & \alpha_o^p + \sum_{i=1}^{34} \alpha_i^p D_i AVGPFT_m + \beta_1^p COMPETITION_i + \beta_2^p UPSCALE_i \\ & + \beta_3^p MONITOR87_i + \gamma_o^p PLAN_{im} + \gamma_1^p PLAN_{im} * COMPETITION_i \\ & + \gamma_2^p PLAN_{im} * UPSCALE_i + \gamma_3^p PLAN_{im} * MONITOR87_i + \varepsilon_{im}^p, \end{aligned} \tag{3}$$

where

$SALES_{im}$ = sales per square foot for store *i* in month *m*,
$AVGSAL_m$ = average sales per square foot in month *m* over all 34 stores,

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[7] The decrease in supervisory monitoring may have been more extensive than these numbers indicate. When all of the effort of sales managers is focused on supervision, this measure accurately captures the degree of supervisory monitoring. However, as detailed in the section describing the incentive plan, the managers' responsibilities included activities other than supervision after the implementation of the plan. The ideal measure for the numerator in this case is the number of managerial hours actually spent on supervision, but since managers at our research site did not record the time they spent on supervision, we did not have the data for computing this ideal measure. Therefore, the measure of postimplementation monitoring is noisy and biased upward because the ratio of the number of managers to the number of sales consultants overstates the degree of monitoring. However, the measure of preimplementation monitoring is unbiased because in 1987, prior to the implementation of the incentive plan, virtually all of the effort of sales managers was focused on supervision alone.

CSI_{iy} = customer satisfaction index for store i in year y,

$AVGCSI_y$ = average customer satisfaction index in year y over all 34 stores,

$PROFIT_{im}$ = profit per square foot for store i in month m,

$AVGPFT_m$ = average profit per square foot in month m over all 34 stores,

$MONITOR87_i$ = the ratio for the number of managers to the number of salespeople during 1987 (prior to the implementation of the incentive plan),

$UPSCALE_i$ = store i's customer profile,

$COMPETITION_i$ = the competitive intensity of store i's market,

D_i = 1 if store i, 0 otherwise,

$PLAN_{im}$ = 1 if store i was under the outcome-based plan in month m, 0 otherwise,

$PLAN_{iy}$ = 1 if store i under outcome-based plan in year y, 0 otherwise,

and

$\varepsilon_{im}{}^s$, $\varepsilon_{iy}{}^c$, and $\varepsilon_{im}{}^p$ are random errors.

These models express store sales, customer satisfaction, and profit as functions of the individual store characteristics existing before and after the implementation of the outcome-based incentive plan. To control for potentially unique selling strategies of the retail company as well as seasonal and economy-wide effects on the performance of all stores, we specified individual store sales, customer satisfaction, and profit in a particular time period as varying in proportion to average sales per square foot (*AVGSAL*), average customer satisfaction index (*AVGCSI*), and average profit (*AVGPFT*), the averages of the corresponding variables over all 34 stores for the same time period.[8] The coefficients $\gamma_o{}^s$, $\gamma_o{}^c$, and $\gamma_o{}^p$ represent the main effects of plan implementation on sales, customer satisfaction, and profit, respectively, after the effects of the contextual factors are controlled for. The coefficients $\beta_j{}^s$, $\beta_j{}^c$, and $\beta_j{}^p$, $j = 1, 2, 3$, ascribed to these variables in the three models, capture the main effects of the three contextual variables. The interaction effects of the contextual variables for stores that implemented the plan are captured by the coefficients of the variables crossed with the dummy variable for plan implementation. For example, $\gamma_3{}^s$, $\gamma_3{}^c$, and $\gamma_3{}^p$ represent the difference in the effect of monitoring on the three performance measures between stores that implemented the plan and those that did not. Hypothesis 3 states that the higher the level of monitoring existing before the implementation of the incentive plan, the smaller the plan's impact on performance. We tested this hypothesis by examining whether the $\gamma_3{}^s$, $\gamma_3{}^c$, and $\gamma_3{}^p$ coefficients were negative in their respective models. A negative $\gamma_3{}^s$ would suggest that gains in sales were smaller in stores in which higher levels of monitoring existed before the implementation of the plan. If the sum of γ_3^s and β_3^s was positive, we inferred that monitoring remained beneficial overall (before supervisory salary costs were considered), even for stores that implemented the plan. Other hypotheses were tested in a similar fashion.

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[8] We also measured the variable as average sales, customer satisfaction, and profit for only the 19 stores that did not implement the plan. The results did not change appreciably.

Statistical Considerations

To ensure that our inferences were reasonable, we evaluated the empirical validity of the assumptions underlying the regression models and examined possible data problems. Because we used time series information to estimate the effect of the incentive plan, serial correlation may have biased the estimated standard errors of the coefficients. We corrected for autocorrelation in the regressions using a variant of the Prais-Winsten (1954) estimator proposed by Park and Mitchell (1980). This estimator is consistent and performs especially well for short time series and trended data (Doran & Griffiths, 1983). It also reduces the extent to which the autocorrelation coefficient tends to be underestimated (Kmenta & Gilbert, 1970).[9]

We accounted for potential heteroskedasticity by dividing the sales of each store by its area (Christie, 1987). Using White's (1980) test procedure, we confirmed that the homoskedasticity assumption is not violated for all three models. In order to evaluate whether extreme and influential observations drive the results, we computed the *RSTUDENT, COV, DFFITS,* and *h* metrics suggested by Belsley, Kuh, and Welsch (1980). We classified observations as influential if two or more of the computed metrics exceeded the suggested cutoff values, deleted them from the sample, and reestimated the models. The reestimated parameters did not exhibit any appreciable changes. We also employed Belsley and colleagues' (1980) collinearity diagnostics to identify possible problems due to multicollinearity between independent variables. The condition indexes were well below the suggested cutoff for models 1 and 3 but above the cutoff for model 2 for customer satisfaction.[10]

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[9] Results of estimating the three different models together as a system of seemingly unrelated regressions (SUR) to account for contemporaneous correlation were similar to the results obtained from estimating separate regressions because most of the independent variables are the same for the three models (Greene, 1994: 488–489).

[10] Our original specification of the estimation models included different intercepts for the 34 stores to allow for possibly different individual store characteristics. A single intercept model was estimated for statistical reasons. The inclusion of 34 intercepts resulted in extreme multicollinearity, and consequently we could not invert the X matrix to estimate the vector of coefficients. We addressed this issue by first deleting the four intercept terms that contributed most to the collinearity. This deletion allowed us to invert the X matrix, but severe multicollinearity problems reflected in highly inflated variances persisted. The condition indexes were greater than 400, well beyond the cutoff of 30 suggested by Belsley and colleagues (1980). The results obtained using these less restricted models are qualitatively similar to the results using the single intercept models shown in Table 3. In the less restricted models with multiple intercepts, only six intercepts are significantly different from zero, and in the restricted models shown in Table 3 the single intercept is not significantly different from zero.

In conclusion, no severe violations of the standard statistical assumptions, or data problems, were noted for the sales and profit models. However, the customer satisfaction model suffered from high collinearity, which may contribute to the weaker results obtained for this model.

RESULTS

Impact on Store Sales

The adjusted R^2 for a regression of store sales on average sales over all stores (*AVGSAL*) alone is 0.9061. This high R^2 is not surprising because average sales controls for seasonality, which is very high in the retail industry. Results of estimating the impact of the three contextual variables on store sales are presented in the first column of Table 3. The overall equation is significant ($p = .0001$), and the adjusted R^2 is 0.9574. The variable for implementation of the plan and the contextual variables explain 55 percent of the remaining variation not explained by the average sales model. The prediction that the γ_j^s, $j = 1, 2, 3$, coefficients are zero for all three contextual variables is not confirmed ($p = .0001$). The main effect of competition is negative and significant, indicating that store sales decrease as competition increases. But, consistent with Hypothesis 1, the interaction effect of competition on store sales is positive and significant, indicating that plan implementation enables a store to capture more customers from its competitors when

TABLE 3
Results of Regression Analyses

		Dependent Variable[a]					
		Sales		Customer Satisfaction Index		Profit	
Independent Variable	Parameter and Expected Sign	*b*	*t*	*b*	*t*	*b*	*t*
Competition	β_1 (−)	−0.03*	−4.66	−0.01	−0.01	−0.07	−0.35
Upscale customer profile	β_2 (+)	0.63*	8.69	0.32	0.45	0.16*	7.72
Monitoring 1987	β_3 (+)	24.15*	40.18	−0.31	−0.03	6.25*	25.44
Plan	γ_0 (?)	−0.22	−0.86	0.95	0.74	0.86*	2.01
Plan × competition	γ_1 (+)	0.08*	8.31	0.07	1.45	0.01*	2.15
Plan × upscale	γ_2 (+)	0.32*	3.19	0.32*	2.76	0.08*	1.89
Plan × monitoring 1987	γ_3 (−)	−9.50*	−6.00	−7.53	−1.58	−5.69*	−4.75
p(model: $\beta_1 = \beta_2 = \beta_3 = \gamma_0 = \gamma_1 = \gamma_2 = \gamma_3 = 0$)		0.0001		0.0001		0.0001	
p(moderators: $\gamma_1 = \gamma_2 = \gamma_3 = 0$)		0.0001		0.0063		0.0001	
Adjusted R^2, full model		0.9574		0.9862		0.9567	
Adjusted R^2, no interaction terms		0.9410		0.9857		0.9547	
Adjusted R^2, control variable only		0.9061		0.9844		0.9413	

[a] For sales, $n = 2{,}618$; for customer satisfaction, $n = 238$; for profit, $n = 2{,}210$.

* $p < .05$, one-tailed test

there is more intense competition. The customer profile variable is positively and significantly related to store sales. The interaction effect is also positive and significant, but smaller than the main effect. These findings lend support to Hypothesis 2, stating that implementing outcome-based incentive plans in stores located in upscale markets results in larger sales gains. Hence, outcome-based plans are likely to be more effective in more competitive and upscale markets. The coefficient (β_3^s) for the main effect of monitoring 1987 is positive and significant, indicating that monitoring is positively associated with sales for all stores. The interaction of monitoring 1987 with plan implementation has a statistically significant negative coefficient (γ_3^s), suggesting that sales gains from implementing an outcome-based control are lower when a high level of behavior-based control exists. This finding supports Hypothesis 3. The sum of the γ_3^s and β_3^s coefficients is positive and significant, implying that even in stores that implemented the incentive plan, monitoring has a net beneficial effect. Finally, γ_0^s is insignificant, indicating that the three contextual factors explain most of the variation in the impact of the incentive plan on store sales.[11]

Impact on Customer Satisfaction

The adjusted R^2 for a regression of store customer satisfaction on average customer satisfaction index values over all sample stores (*AVGCSI*) alone is 0.9844. The second column of Table 3 displays the results of estimating the impact of contextual factors on customer satisfaction. The overall equation is significant ($p = .0001$); the adjusted R^2 is 0.9862. The plan variable and the contextual variables explain 12 percent of the variance not explained by the average customer satisfaction model. The prediction that the γ^c coefficients are zero for all three contextual variables is not confirmed ($p = .0063$). The main effect of competition is negative but not significant. The interaction effect of competition is positive, as in the sales model, but not significant at the 5 percent level ($p = .0650$), thus providing only weak support for the hypothesis that implementing outcome-based incentive plans in competitive markets leads to greater performance gains. The coefficient of the main effect of the upscale customer profile variable is positive but not significantly different from zero. The interaction effect, however, is positive and significant at the 5 percent level, supporting the hypothesis that implementing outcome-based incentive plans in stores located in upscale markets results in larger gains in customer satisfaction. Outcome-based plans are likely to be more effective, therefore, in upscale markets in which customers value customer-focused service. The main effect of monitoring is not statistically different from zero, and the interaction effect of monitoring 1987 is negative but not significant at the 5 percent level ($p = .0574$). Finally, as in the sales model, the main effect of plan implementation is not statistically significant when contextual variables are included, suggesting that those variables explain most of the variation in the impact of the incentive plan on customer satisfaction as well.

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[11] The fact that γ_0^s is insignificant indicates that there is no intercept change for the stores that implemented the plan relative to stores that did not. We can also assess whether there is any residual difference in variance between the plan and nonplan stores that is not explained by the contextual variables by comparing the R^2 for the model with the contextual variables, interaction terms, and the plan dummy variable against the R^2 for the model without the plan dummy. The resultant F-test is equivalent to the t-test of the null hypothesis $\gamma_0^s = 0$ for the separate plan dummy variable (Greene, 1994: 206; Johnston, 1972: 143–152).

Impact on Profit

The adjusted R^2 for a regression of store profit on profit per square foot averaged over all stores (*AVGPFT*) alone is 0.9413. The results of estimating the impact of the contextual variables on store profit appear in the last column of Table 3. The overall equation is significant ($p = .0001$); the adjusted R^2 is 0.9567. The plan variable and the contextual variables explain 26 percent of the variation not explained by the average profit model. The prediction that the γ^p coefficients are zero for all three contextual variables is not confirmed ($p = .0001$). All results except the main effect of competition and the main effect of plan implementation are similar to those for the sales model. The coefficient of the main effect of competition is negative but not significant. In contrast to the sales and the customer satisfaction models, in this model the main effect of plan implementation is positive and statistically significant when the contextual variables are included, suggesting that they do not explain all the variation in the impact of the incentive plan on profitability and that other factors influencing costs and pricing decisions may also moderate the plan's impact.

Managerial Significance

To evaluate the managerial significance of the above results, we combined the regression estimates with the means and standard deviations of the variables for the 15 experimental stores to compute the impact of the contextual variables on the change in each dependent variable occurring as a result of implementing the incentive plan. Table 4 presents the percentage change in the three performance measures resulting from the plan implementation and analyzes it by the contextual variables. The first panel of Table 4 shows the average percentage increase in each performance measure. The second and the third panels show the percentage change when all contextual variables are one standard deviation above and below their mean levels. These estimates suggest that stores in competitive areas were likely to benefit most from the incentive plan, but the potential benefits were offset to a large extent when supervisory monitoring was high before plan implementation. Although managers cannot change the contextual variables, these insights are useful in deciding where to implement a customer-focused strategy coupled with an outcome-based control system.

DISCUSSION AND CONCLUSION

Recent research in human resource management recognizes the importance of identifying contextual factors that help discriminate between situa-

TABLE 4
Managerial Significance of the Impact of the Contextual Variables on Store Performance[a]

Contextual Variables and Level	Sales	Customer Satisfaction Index	Profit
Mean			
Plan × competition	17.90%	4.40%	7.98%
Plan × upscale customer profile	0.91	0.26	0.82
Plan × monitoring 1987	−12.60	−2.86	−27.39
Plan	−1.35	1.64	18.82
Total impact	4.89	3.44	4.44
Mean plus standard deviation			
Plan × competition	24.10	6.03	10.94
Plan × upscale customer profile	3.99	1.14	3.62
Plan × monitoring 1987[b]	−8.02	−1.82	−17.43
Plan	−1.35	1.64	18.82
Total impact	18.72	6.99	15.95
Mean minus standard deviation			
Plan × competition	11.10	2.78	5.03
Plan × upscale customer profile	−2.18	−0.62	− 1.98
Plan × monitoring 1987[b]	−17.18	−3.89	−37.35
Plan	−1.35	1.64	18.82
Total impact	−10.23	−0.09	−15.44

[a] Values are percentage changes.

[b] Since the predicted sign for plan times monitoring 1987 is negative, the standard deviation was subtracted from the mean in the second panel and added to the mean in the third panel.

tions in which outcome-based incentive plans will be effective and those in which they will not be (Gerhart & Milkovich, 1992; Gerhart et al., 1994). This observation stems in part from the mixed and inconclusive results from the prior empirical research that has sought to evaluate the *average* impact of such incentive plans. Anecdotal evidence reported largely in practitioner-oriented publications also recounts stories of some organizations in which the implementation of outcome-based incentive plans has been very successful and some other organizations in which it has been a failure. It is of interest, therefore, to explain why researchers have observed such differences in the effectiveness of outcome-based incentive plans in different organizations. More important, if we are to advance conceptual understanding of why and how outcome-based incentives impact organizational performance, it is essential that the role of the contextual factors that moderate this relationship between incentives and performance be understood.

In this research, we restricted our attention to outcome-based incentive plans that are implemented to support a customer-focused service strategy. This combination of a shift to a customer-focused strategy and a control system based on pay-for-performance has become common in recent years, especially in service organizations (Kochan & Osterman, 1994; Schlesinger &

Heskett, 1991b; Zeithaml et al., 1993). By focusing on this specific form of outcome-based incentive plan, we were able to derive relatively sharp hypotheses about the contextual variables that moderate their effectiveness. Our empirical research evaluates these hypotheses in the context of one firm in the retail industry. The design of any empirical research entails trading the availability of rich, highly reliable data from one organization off against the greater external validity of a broad sample of organizations representing different industries. In this study, we chose the first alternative because we had access to a long time series of data for groups of both experimental and control stores operating in a context that faithfully represented the theoretical constructs of interest to our research.

A customer-focused service strategy requires sales consultants to identify and satisfy the needs of individual customers. As a result, the programmability of their tasks decreases. Organizational control theory suggests, therefore, that outcome-based control fits a customer-focused service strategy. However, this fit only implies that among service outlets adopting a customer-focused service strategy, those employing outcome-based control will perform better. But in practice we find customer-focused service strategies implemented simultaneously and in conjunction with outcome-based control (Schlesinger & Heskett, 1991b; Zeithaml et al., 1993), as was the case at our research site. Therefore, to explain differential performance impacts, we needed to understand the fit between the service strategy–control system dyad and the environmental context in which they were implemented. Theoretical considerations suggested that customer focus would be more effective in winning new customers from competitors when competition was more intense and customers were more demanding. We found strong empirical support for hypotheses predicting that the impact on store sales, profits, and customer satisfaction of an outcome-based incentive plan implemented to support a customer-focused service strategy is higher in highly competitive and upscale markets.

We also examined the interaction between outcome-based control and behavior-based control, as prior research suggested that the two are substitutes for each other (Conlon & Parks, 1990; Eisenhardt, 1985). Specifically, the potential for performance improvement from implementing an outcome-based incentive plan is lower when a high level of behavior-based control already exists. We found strong evidence indicating that low levels of performance improvement resulting from incentive plan implementation were associated with the prevalence of high levels of supervisory monitoring before the implementation. Furthermore, the level of supervisory monitoring appears to have decreased subsequent to the implementation of the plan.

This study is an initial step in our efforts to understand the determinants of the performance impact of outcome-based incentives implemented to support a customer-focused service strategy. Although we found empirical support for predictions based on our theoretical analysis, several interesting questions remain to be researched. Our empirical study is restricted to only one retailer, but customer-focused service and outcome-based incentives are common in many other service industries. It will be important to evaluate the robustness of our results in these other contexts. Our empirical analysis is based on organization-level performance data. It would be of interest to examine individual-level data to evaluate the interactions between individual-level incentives, individual characteristics such as experience, and other human resource management practices, such as selection and retention, that affect individuals differentially.

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APPENDIX

Customer Satisfaction Index

Questions were "Salespeople are available when I have a question," "Salespeople seem genuinely interested in helping me," "Salespeople are courteous," and "Salespeople go the extra mile to make me feel like a valued customer" (α = .92; variation explained by largest eigenvalue = 0.8765).

Responses, made by checking boxes, were "strongly agree," "agree," "disagree," and "strongly disagree." For each of the seven years, the company computed an overall store weighted-average response as follows: (100 × percent of store responses stating "strongly agree") + (70 × percent of store responses stating "agree"). Each store's weighted average was based on between 300 and 900 customer surveys.

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RESEARCH NOTES

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THE IMPACT OF HUMAN RESOURCE MANAGEMENT PRACTICES ON PERCEPTIONS OF ORGANIZATIONAL PERFORMANCE

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In 590 for-profit and nonprofit firms from the National Organizations Survey, we found positive associations between human resource management (HRM) practices, such as training and staffing selectivity, and perceptual firm performance measures. Results also suggest methodological issues for consideration in examinations of the relationship between HRM systems and firm performance.

In recent years, U.S. companies have been urged to adopt a variety of performance-enhancing or *progressive* human resource management (HRM) practices to improve their competitiveness in the global marketplace (U.S. Department of Labor, 1993). Such recommendations are unsurprising given that professionals and academics have long asserted that the way in which an organization manages people can influence its performance. Spurred by Peters and Waterman's (1982) description and assessment of "excellent" organizations, the past decade has produced many testimonials to the value of progressive HRM practices and systems of such practices. In particular, employee participation and empowerment and job redesign, including team-based production systems, extensive employee training, and performance-contingent incentive compensation, are widely believed to improve the performance of organizations (Pfeffer, 1994). Moreover, a developing body of research has reported positive associations between firm-level measures of HRM systems and organizational performance (Arthur, 1994; Cutcher-Gershenfeld, 1991; Delaney, forthcoming; Huselid, 1995; Huselid & Becker, 1994; Ichniowski, Shaw, & Prennushi, 1994; MacDuffie, 1995). Substantial uncertainty remains, however, as to *how* HRM practices affect organizational

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outcomes, whether some practices have stronger effects than others, and whether complementarities or synergies among such practices can further enhance organizational performance (Baird & Meshoulam, 1988; Jackson & Schuler, 1995; Lado & Wilson, 1994; Milgrom & Roberts, 1995; Wright & McMahan, 1992).

This study extends empirical research on the firm-level impact of progressive HRM practices in three ways. First, we draw on a unique national probability sample of for-profit and nonprofit organizations to evaluate the association between a variety of progressive HRM practices and perceptual measures of organizational performance. Second, we conduct some rudimentary empirical tests of the effect of complementarities *among* HRM practices on firm-level outcomes. Finally, we identify some important methodological issues that merit consideration as scholars and practitioners seek to better understand the relationship between HRM practices and firm performance.

BACKGROUND AND HYPOTHESES

Research focusing on the firm-level impact of HRM practices has become popular in recent years (for reviews, see Appelbaum and Batt [1994]; Berg, Appelbaum, Bailey, and Kalleberg [1994]; Huselid [1995]; Ichniowski et al. [1994]; and Wagner [1994]). The literature includes studies that focus on the performance effects of specific HRM practices, such as training (Bartel, 1994; Knoke & Kalleberg, 1994) and information sharing (Kleiner & Bouillon, 1988; Morishima, 1991), and research that examines the influence of systems of such practices on organizational outcomes (Huselid, 1995; Huselid & Becker, 1994; Ichniowski et al., 1994; MacDuffie, 1995). Although many studies have reported a positive association between various HRM practices and objective and perceptual measures of firm performance, some authors (Levine & Tyson, 1990; Wagner, 1994) have expressed concern that results may be biased because of methodological problems. In addition, the absence of a widely accepted measure of the "progressive" or "high performance" HRM practices construct makes it difficult to compare findings across studies (for examples of different approaches, see Appelbaum and Batt [1994]; Cutcher-Gershenfeld [1991]; Huselid [1995]; Ichniowski et al. [1994]; and MacDuffie [1995]). Nonetheless, the literature can be generally categorized as optimistic concerning the potential for progressive HRM practices to enhance the performance of employees and organizations. The optimism has stimulated additional theoretical and empirical research.

Scholars from different disciplines have suggested various conceptual frameworks as explanations for the links between progressive HRM practices and firm-level outcomes. Jackson and Schuler (1995) reviewed this literature and reported that approaches as divergent as general systems theory (von Bertalanffy, 1950), role behavior theory (Katz & Kahn, 1978), institutional theory (Meyer & Rowan, 1977), resource dependence theory (Pfeffer & Cohen, 1984), human capital theory (Becker, 1964), transaction cost economics (Williamson, 1979), agency theory (Jensen & Meckling, 1976), and the resource-based theory of the firm (Barney, 1991) have been used to study the potential role of human resources (and thus HRM practices) in the determination of firm performance. Although a review of each of these frameworks is beyond the scope of this study, the prior conceptual work generally converges on the importance of HRM practices in the determination of both employee and firm-level outcomes. Conceptually, such practices can be classified in terms of their impact on employees' skills and ability, motivation, and the way that work is structured (Arthur, 1994; Bailey, 1993; Cutcher-Gershenfeld, 1991; Huselid, 1995; Ichniowski et al., 1994; Kochan & Osterman, 1994).

Organizations can adopt various HRM practices to enhance employee skills. First, efforts can focus on improving the quality of the individuals hired, or on raising the skills and abilities of current employees, or on both. Employees can be hired via sophisticated selection procedures designed to screen out all but the very best potential employees. Indeed, research indicates that selectivity in staffing is positively related to firm performance (Becker & Huselid, 1992; Schmidt, Hunter, McKenzie, & Muldrow, 1979). Second, organizations can improve the quality of current employees by providing comprehensive training and development activities *after* selection. Considerable evidence suggests that investments in training produce beneficial organizational outcomes (Bartel, 1994; Knoke & Kalleberg, 1994; Russell, Terborg, & Powers, 1985).

The effectiveness of skilled employees will be limited, however, if they are not motivated to perform their jobs. The form and structure of an organization's HRM system can affect employee motivation levels in several ways. First, organizations can implement merit pay or incentive compensation systems that provide rewards to employees for meeting specific goals. A substantial body of evidence has focused on the impact of incentive compensation and performance management systems on firm performance (Gerhart & Milkovich, 1992). In addition, protecting employees from arbitrary treatment, perhaps via a formal grievance procedure, may also motivate them to work harder because they can expect their efforts to be fairly rewarded (Ichniowski, 1986; Ichniowski et al., 1994).

Finally, the way in which a workplace is structured should affect organizational performance to the degree that skilled and motivated employees are directly involved in determining *what* work is performed and *how* this work gets accomplished. Employee participation systems (Wagner, 1994), internal labor markets that provide an opportunity for employees to advance within a firm (Osterman, 1987), and team-based production systems (Levine, 1995) are all forms of work organization that have been argued to positively affect firm performance. In addition, it has been argued that the provision of job security encourages employees to work harder. As Ichniowski and his associates noted, "Workers will only expend extra effort. . . if they expect. . . a lower probability of future layoffs" (1994: 10). Because it is also unlikely that rational employees will identify efficiency-enhancing changes in work structures if such changes would eliminate their jobs, the provision of job security should encourage information sharing (Levine, 1995: 55–58). Taking these arguments as a whole, then, we expect

> *Hypothesis 1: Progressive HRM practices (those affecting employee skills, employee motivation, and the structure of work) will be positively related to organizational performance.*

The first hypothesis proposes that individual HRM practices have a positive "main effect" on firm-level outcomes. As we note in our later discussion of the different HRM practice measures, however, the exact mechanisms creating that positive association may vary somewhat across practices. Recent conceptual work has also argued that complementarities, or synergies, both *among* a firm's HRM practices and *between* a firm's HRM practices and its competitive strategy, can have an additional and positive effect on firm performance (Baird & Meshoulam, 1988; Milgrom & Roberts, 1995). An example of the former would be an increase in the returns from the adoption of an employee training program when it was matched with a rigorous selection system that identified the employees most likely to benefit from training. An illustration of the latter would be the occurrence of additional firm-level returns when an organization's HRM system was aligned with and supportive of its operational goals and competitive strategy. The notion of complementarities is intuitively appealing, but it is not easily measured. Consequently, recent work evaluating this concept (Huselid, 1995; Ichniowski et al., 1994; MacDuffie, 1995) has employed divergent measures of HRM complementarity, and the empirical results have been mixed. Although data limitations prevented us from constructing measures of complementarity between organizational strategy and HRM practices, the paucity of empirical evidence on this subject led us to develop several crude measures of complementarity among HRM practices for the firms in our sample. Accordingly,

> *Hypothesis 2: Complementarities or synergies* among *progressive HRM practices will be positively related to organizational performance.*

METHODS

Data

Our data were obtained from the National Organizations Survey (NOS), a special module of the General Social Survey (GSS), which was conducted in 1991 with support from the National Science Foundation. The NOS "surveyed a representative sample of U.S. work establishments about their structure, context, and personnel practices" (Kalleberg, Knoke, Marsden, & Spaeth, 1994: 860). By design, the NOS is based on a national probability sample of establishments and organizations in the United States. The sample frame was identified from information provided by respondents to the 1991 GSS on the organizations for which they worked. As the GSS is a national equiprobability sample, this method produces a sampling frame in which the probability that an organization is included in the sample is proportionate to the number of people it employs (Spaeth & O'Rourke, 1994).

This procedure yielded a sampling frame of 1,427 organizations. Of these organizations, it was possible for the research team to contact 1,127 (79 percent of the sample frame). These organizations were asked by telephone to participate in a survey addressing organizational characteristics, policies, and practices relevant to HRM. Representatives of 727 organizations (64.5 percent of the organizations that could be contacted; 50.9 percent of the total sample frame) completed either a telephone interview or a questionnaire survey. The median NOS telephone interview lasted 42 minutes. Analyses indicated that, with respect to industry, occupation, and establishment size, the 727 organizations were "reasonably representative" of the population of organizations the NOS was intended to sample (Spaeth & O'Rourke, 1994: 882).

The NOS gathered objective and perceptual data on HRM practices and perceptual indicators of organizational performance. Information on the financial performance of organizations was not collected, and NOS researchers' assurances to respondents of confidentiality precluded the ex post collection of such data. For some measures, such as the effectiveness of organizational training, informants were asked to provide their perceptions on Likert-type scales. For other measures, such as organization size, respondents provided extensive factual data. Multiple respondents were contacted (in 17 percent of the cases) and respondents were interviewed more than once (in 26 percent of the cases) if it was necessary for them to review organizational records to obtain the factual information requested. As a result, the NOS provides a broad array of information on a representative sample of U.S. organizations.

In a general descriptive analysis of the measures collected in the NOS, Kalleberg and Moody (1994) noted that the survey focused on a narrow range of HRM practices and, as a result, is not appropriate for a comprehensive analysis of the association between progressive HRM practices and organizational performance. Nonetheless, the means and zero-order correlations presented by Kalleberg and Moody (1994) suggested some promising associations between a variety of HRM practices and single-item perceptual measures of firm performance. Given the problems associated with single-item measures of performance and evidence of collinearity across HRM practices in the NOS data (Kalleberg & Moody, 1994), a multivariate analysis of the association between HRM practices and perceptions of performance is needed. After describing the measures and estimation model, we report the results of such an analysis.

Measures

Dependent variables. Because financial measures of firm performance were not collected by the NOS research team, we created two perceptual measures of organizational performance from the items contained in the NOS. The measures we employ are relative, or benchmarked, in the sense that they are derived from questions asking informants to assess organizational performance relative to the performance of industry competitors. Although perceptual data introduce limitations through increased measurement error and the potential for monomethod bias, it is not unprecedented to use such measures. Research has found measures of perceived organizational performance to correlate positively (with moderate to strong associations) with objective measures of firm performance (Dollinger & Golden, 1992; Powell, 1992). In addition, the use of perceptual measures permits an analysis of profit-making and nonprofit organizations (objective firm performance data are generally unavailable for the latter). Table 1 presents the 11 NOS questions that we used to construct the dependent variables. The first variable was constructed from seven items assessing respondents' perceptions of their firm's performance over the past three years relative to that of similar organizations (*perceived organizational performance*, $\alpha = .85$). The second dependent variable is available only for profit-making organizations and was constructed from four questions concerning respondents' perceptions of their firm's performance over the past three years relative to product market competitors (*perceived market performance*, $\alpha = .86$). Each of the dependent variables is based on questionnaire items answered on Likert scales ranging from 1, "worse" to 4, "much better."

Together these variables provide a broad assessment of perceptions of organizational performance. The perceived organizational performance measure gets at important issues such as product quality, customer satisfaction, and new product development. The perceived market performance variable focuses more narrowly on economic outcomes such as profitability and market share. Given the nascent stage of the literature, examination of alternative dependent variables and samples should provide important confirmatory information on the association between HRM practices and firm performance.

Independent variables. Table 1 also includes information on the HRM practice measures included in our empirical models. Although we were constrained in the development of these items by the questions contained in the NOS, we sought to develop as wide a variety of progressive HRM practices as was possible.

Organizations can influence the skills of employees through selectivity in hiring and employee training. We measured selectivity in staffing using a variable that captures the number of applicants considered for each position filled by an organization for three different types of employees—those in the occupation most directly involved with the organization's primary product (core employees); those in the occupation of the respondent to the GSS; and managers. We averaged the standard scores for the logged value of these responses to form the *staffing selectivity* index ($\alpha = .66$). We measured the extensiveness of employee training using a 3-item index that included a variable indicating whether the organization had provided any formal job training in the past two years, the number of employees that had received formal training in that time period, and respondents' views on the overall effectiveness of their training programs, using a scale that ranged from 1, "not at all effective," to 3, "highly effective." These measures were standardized and averaged to create our *training* index ($\alpha = .88$).

One of the primary means organizations use to enhance employee motivation is providing performance-contingent incentive compensation

(Gerhart & Milkovich, 1992; Kandel & Lazear, 1992) to align employee and shareholder interests. In our analyses we used a three-item index of *incentive compensation* ($\alpha = .83$) that reports respondents' perceptions of how important job performance is in determining the earnings of the three primary occupational groups identified above. In addition, employees may be less inclined to shirk when organizational HR management practices promote equitable treatment (Levine, 1995: 58–59). To represent this concept, we used a dummy variable indicating the existence of a formal procedure for resolving disputes between employees and supervisors or co-workers (*grievance procedure,* 0 = no, 1 = yes).

Job or work structures have also been argued to enhance firm performance by allowing skilled and motivated employees to become more involved in determining what work is to be done and how it is to be performed. Although employee involvement programs are regularly advocated as a means to increased firm performance (Levine, 1995), the NOS contained little information on employee participation. As a result, we represent employee involvement in decisions with an 8-item scale ($\alpha = .91$) that indicates the level at which important organizational decisions rest (such as hiring or performance evaluation). This variable is scaled so that the lowest value occurs if the CEO makes these decisions and higher values occur if the decisions are made by "someone lower in the organization"; the variable is called *decentralized decision making.*

Internal labor markets for employee promotions and the provision of employment security are also forms of work structure that have been held to positively affect firm performance (Ichniowski et al., 1994; Osterman, 1987; Pfeffer, 1994). Although we could not measure these constructs directly, we used NOS data to create two alternative indicators of organizational advancement opportunities. First, we developed a 5-item *internal labor market* index ($\alpha = .82$) that captures the existence of opportunities for promotion from within; for each item, response options were "yes" and "no" (coded 2 and 1, respectively). Although this measure only partially reflects the concept of employment security, it offers an indication of organizations' willingness to extend organizational security through internal promotions. Second, we included in the model the number of occupation levels in the organization between the highest and lowest jobs (*vertical hierarchy*). Because many organizations have made efforts to flatten their positional hierarchies, this variable captures the extent to which organizations are able to provide promotion opportunities. Although potential promotion ladders do not guarantee promotions, because they indicate to employees the value of retaining organization-specific skills that transfer between positions they should be positively related to performance measures.

Taken as a whole, these seven items provide a reasonably broad reflection of the progressive HRM practices that have been identified in the literature. As noted above, however, HRM systems, rather than individual practices, are the appropriate level of analysis when an estimate of the firm-level effect of HRM practices is desired. Essentially, collinearity among HRM practices

TABLE 1[a]
Questionnaire Items for the Independent and Dependent Variables

Variable and Items	Mean	Range	α
Perceived organizational performance			
How would you compare the organization's performance over the past *3 years* to that of other organizations that do the same kind of work? What about. . .			
Quality of products, services, or programs?	3.26	1–4	.85
Development of new products, services, or programs?	3.02		
Ability to attract essential employees?	2.88		
Ability to retain essential employees?	3.01		
Satisfaction of customers or clients?	3.17		
Relations between management and other employees?	3.00		
Relations among employees in general?	2.96		
Perceived market performance[a]			
Compared to other organizations that do the same kind of work, how would you compare the organization's performance over the last *3 years* in terms of. . .			
Marketing?	2.88	1–4	.86
Growth in sales?	2.92		
Profitability?	2.90		
Market share?	2.82		
Employee skills			
Staffing selectivity[b]			
In the past 2 years, about how many applications have you considered for each CORE opening?	0.10		.66
In the past 2 years, about how many applications have you considered for each GSS opening?	0.08		
In the past 2 years, about how many applications have you considered for each MANAGERIAL opening?	0.09		
Training effectiveness[b]			
Apart from on-the-job training, in the past *2 years* did the organization provide *any* employees with formal job training, either on or off the premises?	0.05		.88
Within the last 2 years, how many employees participated in formal job training?	0.08		
Overall, how effective would you say your employee training is?	0.04		

TABLE 1 (continued)

Variable and Items	Mean	Range	*α*
Employee motivation			
Incentive compensation			
How important is job performance in determining the earnings of managers and administrators?	2.73	1–3	.83
How important is job performance in determining the earnings of COREs?	2.56		
How important is job performance in determining the earnings of *most* GSSs?	2.55		
Grievance procedure			
Are there formal procedures for resolving disputes between employees and their supervisors or coworkers?	0.70	0–1	
Structure of jobs and work			
Decentralized decision making			
Who *actually* makes the *final* decision about the number of people employed here?	2.78	1–5	.91
Who *actually* makes the *final* decision about which new employees to hire?	3.77		
Who *actually* makes the *final* decision about using subcontractors or temporary employees?	3.50		
Who *actually* makes the *final* decision about evaluating worker performance?	4.11		
Who *actually* makes the *final* decision about worker promotions?	3.63		
Who *actually* makes the *final* decision about wage rates or salary levels?	2.75		
Who *actually* makes the *final* decision about discharging or laying off workers?	3.34		
Who *actually* makes the *final* decision about work scheduling and overtime?	4.10		
Internal labor market			
Do you sometimes fill CORE vacancies with people already employed at the organization?	1.59	1–2	.82
Is it possible for a CORE to be promoted to a level *above* CORE?	1.74		
Do you sometimes fill GSS vacancies with people already employed at the organization?	1.56		
Is it possible for a GSS to be promoted to a level *above* GSS?	1.69		
Do you sometimes fill managerial or administrative vacancies with people already employed at the organization?	1.75		
Vertical hierarchy[c]			
About how many levels are there between the lowest and highest positions at the organization, including both the lowest and highest levels?	1.85		

[a] $N = 590$, except for perceived market performance, where $N = 373$. Latter was available only for publicly held firms.

[b] Standard score of logged value for all.

[c] Value is a logarithm.

may cause studies focusing on one practice at a time to overestimate its contribution to firm performance. At the same time, studies including multiple HRM practice measures may understate the effects of those practices in two ways. First, collinearity among the HRM variables inflates their estimated standard errors and reduces the likelihood that individual HRM coefficients will achieve statistical significance. Second, such studies may understate the combined firm-level effect of the multiple measures to the extent that complementarities exist among the HRM practices (Huselid, 1995; MacDuffie, 1995). These possibilities have led researchers to employ various data reduction procedures, such as cluster analysis (Ichniowski et al., 1994) and factor analysis (Huselid, 1995) to create HRM practice bundles or clusters. Unfortunately, the mixture of dichotomous and ordinal measures contained in the NOS precluded those approaches because of the extreme degree of nonnormality exhibited in the data (Nunnally & Bernstein, 1994). Thus, we used multiple regression analysis to examine the individual and joint effects of progressive HRM practices.

Measures of complementarity. We explored two broad categories of empirical specifications to evaluate the potential for complementarity among HRM practices. First, assuming that returns from investments in progressive HRM practices are enhanced to the degree a firm invests in such practices at a uniform (and high) level throughout, we created a variable that indicates the number of practices for which each firm was above the sample median (range: 0 to 7). A significant positive coefficient on this variable, with all other HRM practices under consideration controlled, should reflect the magnitude of any synergistic effect of investing widely in such practices. Second, following Venkatraman (1989), we conceptualized the potential for complementarity in terms of a moderated or interactive relationship. As noted above, moderation could be said to exist if the returns for training, for example, varied across the level of staffing selectivity. As noted below, based on conceptual groupings, we examined various interactions among the HRM practices. We stress that these analyses are highly exploratory, however, and the results should be interpreted cautiously.

Control variables. To capture other organizational and environmental forces that are related to both the adoption of HRM practices and organizational performance, our regressions include several control variables. Because of differences in priorities, culture, and environment related to organizational mission and goals, we included a dummy variable that indicates whether an organization is nonprofit or for-profit (*nonprofit organization*). To capture size and scale effects, we included a dummy variable to indicate whether an organization is a subsidiary of another organization (*subsidiary*) and the natural logarithm of the number of employees in the organization (*log of total employment*). We also included the age of the firm in years (*firm age*, calculated as 1991 minus the founding year) to capture any founding values (Stinchcombe, 1965) and maturation effects.

The degree of product or service market competition faced by an organization likely influences both its performance and its HRM practices. We therefore controlled for competition with a variable called *market competition;* respondents were asked the amount of competition faced by the organization in its primary product or service market (1 = none, 4 = a great deal). We also included two dummy variables to indicate whether the firm produced a product (*product*) or delivered a service (*service*). The omitted category for these comparisons was composed of firms that offered both products and services.

There is much evidence that unions affect firm performance (Freeman & Medoff, 1984). Thus, we included an index called *union pressure* (α = .81) measuring respondents' perception of the influence of unions on their organization. Higher values of this index reflect a greater amount of union influence on management. Although this measure is less desirable than conventional measures of union density or coverage, it was the only measure of union influence available in the NOS. We also included a variable indicating the percentage of employees in managerial occupations (*percent managers*) to capture omitted organizational factors. For example, progressive HRM practices have been viewed as a substitute for monitoring (Kandel & Lazear, 1992) and, with size held constant, a firm's ability to monitor depends somewhat on the number of managers it employs. Relative managerial employment could also capture the extent of organization fat or bureaucracy, which may constrain the effects of progressive HRM practices. Finally, we include 33 dummy variables representing two-digit Standard Industrial Classification (SIC) industries to capture any other industry characteristics associated with performance perceptions.

RESULTS

Table 2 provides descriptive statistics and correlations for all variables. The correlation between the two dependent variables is .51. Consistent with prior work, the relationship between the HRM practices and perceptual performance measures is generally positive (11 of 14 correlations). The magnitude of the correlations is generally small to moderate, however, potentially raising questions about the substantive importance of HRM practices. Associations among HRM practices also tend to be positive (19 of 21 correlations).

We focus on the coefficients on the HRM practice variables in our discussion of the results. Inspection of Tables 3 and 4 shows, however, that many of the control variables are significantly associated with the perceptual performance variables. Table 3 (models 1–5) reports results of the regression equations for perceived organizational performance and Table 4 (models 6–10) presents the results for perceived market performance. Each of the HRM practice coefficients reported in the first column of Table 3 is from a separate regression that contained the control variables and that one HRM practice. The model 1 results indicate that five of the seven HRM practice coefficients are positive and significant. Only the internal labor market and staffing selectivity coefficients are insignificant at conventional levels. Models 2 and 3 report results obtained when the HRM practices are included simultaneously in the same equation. Two equations are reported because the internal labor

TABLE 2
Means, Standard Deviations, and Correlations for All Variables[a]

Variables	Mean	s.d.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Perceived organizational performance	3.05	0.65																		
2. Perceived market performance	2.85	0.76	.51																	
3. Staffing selectivity	0.09	0.79	.01	.19																
4. Training	0.05	0.88	.06	.19	.38															
5. Incentive compensation	2.62	0.59	.17	.13	.05	.01														
6. Grievance procedure	0.70	0.46	−.06	.12	.30	.47	−.08													
7. Decentralized decision making	3.49	0.97	.07	−.01	.24	.26	.18	.08												
8. Internal labor market	1.67	0.35	−.06	.20	.38	.56	.02	.52	.22											
9. Vertical hierarchy	1.85	0.66	.02	.17	.27	.46	−.01	.41	.32	.52										
10. Nonprofit organization	1.35	0.48	−.21		.21	.26	−.23	.40	−.08	.20	.17									
11. Subsidiary	1.44	0.50	.11	−.12	−.12	−.30	.07	−.43	.26	−.42	−.25	−.17								
12. Log of total employment	4.15	2.36	−.06	.11	.42	.64	−.04	.56	.49	.67	.62	.29	−.29							
13. Log of firm age	3.16	1.18	−.17	−.10	.21	.28	−.01	.31	.20	.34	.28	.36	−.10	.43						
14. Percent managers	0.24	0.28	.00	−.22	−.35	−.50	.05	−.49	−.20	−.55	−.46	−.27	.25	−.67	−.30					
15. Union pressure	1.40	0.59	−.12	−.02	.15	.26	−.33	.35	.00	.28	.25	.21	−.28	.36	.17	−.29				
16. Product	0.15	0.36	.04	.00	−.03	.11	−.01	.06	.19	.11	.12	−.30	−.07	.24	.04	−.11	.11			
17. Service	0.74	0.44	−.05	.05	−.01	−.06	−.03	−.07	−.20	−.16	−.10	.37	.09	−.19	−.01	.08	−.11	−.72		
18. Both product and service	0.10	0.30	.02	−.06	.05	−.04	.06	.03	.07	.10	.00	−.17	−.05	.00	−.03	.02	.02	−.14	−.58	
19. Market competition	0.44	0.50	.12	−.03	−.01	.08	.18	−.08	.17	.06	.04	−.38	−.02	.07	−.05	−.04	−.07	.20	−.21	.06

[a] $N = 590$, except for perceived market performance, where $N = 373$. All correlations (except those involving perceived market performance) greater than .05 are significant at the .05 level; those greater than .07 are significant at the .01 level; and those greater than .10 are significant at the .001 level (one-tailed tests). For the correlations involving perceived market performance, all correlations greater than .09 are significant at the .05 level; those greater than .12 are significant at the .01 level; and those greater than .16 are significant at the .001 level (one-tailed tests).

TABLE 3
Results of Regression Analyses for Perceived Organizational Performance[a]

Variable	Model 1[b]	Model 2	Model 3	Model 4	Model 5
Constant	Yes	3.517**	3.167**	3.344**	3.134**
		(0.330)	(0.288)	(0.732)	(0.472)
Staffing selectivity	0.044	0.015	0.011	−0.001	−0.008
	(0.038)	(0.038)	(0.038)	(0.041)	(0.040)
Training	0.130**	0.125**	0.111**	0.123**	0.111**
	(0.040)	(0.041)	(0.040)	(0.041)	(0.040)
Incentive compensation	0.137**	0.120**	0.117**	0.110†	0.098
	(0.048)	(0.048)	(0.048)	(0.086)	(0.085)
Grievance procedure	0.112†	0.078	−0.059	−0.048	−0.012
	(0.081)	(0.082)	(0.081)	(0.296)	(0.295)
Decentralized decision making	0.049†	0.032	0.030	−0.087	0.057
	(0.038)	(0.039)	(0.039)	(0.192)	(0.099)
Internal labor market	−0.058	−0.156	No	−0.037	No
	(0.111)	(0.112)		(0.369)	
Vertical hierarchy	0.117*	No	0.103*	No	0.164
	(0.051)		(0.051)		(0.188)
Training × staffing	No	No	No	0.053	0.072†
				(0.046)	(0.045)
Grievance × incentive compensation	No	No	No	0.013	0.029
				(0.104)	(0.103)
Internal labor market × decentralized decision making	No	No	No	−0.031	No
				(0.108)	
Vertical hierarchy × decentralized decision making	No	No	No	No	−0.014
					(0.051)
Nonprofit organization	Yes	−0.209**	−0.203*	−0.205*	−0.201*
		(0.092)	(0.092)	(0.092)	(0.092)
Subsidiary	Yes	0.100†	0.128*	0.089†	−0.107†
		(0.068)	(0.067)	(0.069)	(0.068)
Log of total employment	Yes	−0.022	−0.044*	−0.028	−0.047*
		(0.024)	(0.024)	(0.025)	(0.024)
Log of firm age	Yes	−0.073**	−0.076**	−0.076**	−0.078**
		(0.026)	(0.026)	(0.026)	(0.026)
Percent managers	Yes	−0.203†	−0.159	−0.244†	−0.207†
		(0.130)	(0.128)	(0.137)	(0.135)
Union pressure	Yes	−0.051	−0.055	−0.046	−0.051
		(0.054)	(0.053)	(0.055)	(0.055)
Product	Yes	0.038	0.062	0.052	0.060
		(0.118)	(0.116)	(0.118)	(0.117)
Service	Yes	−0.065	−0.074	−0.065	−0.079
		(0.098)	(0.098)	(0.098)	(0.098)
Competitive pressure	Yes	−0.004	−0.001	−0.004	0.001
		(0.059)	(0.059)	(0.059)	(0.059)

TABLE 3 (continued)

Variable	Model 1[b]	Model 2	Model 3	Model 4	Model 5
SIC industry dummies	Yes	Yes	Yes	Yes	Yes
R^2		0.182	0.186	0.185	0.190
F		2.515**	2.570**	2.387**	2.468**
ΔR^2		0.032	0.036	0.002	0.003
F for ΔR^2		3.582**[c]	3.953*[c]	0.445[d]	0.868[d]
N	590	590	590	590	590

[a] Unstandardized regression coefficients are reported, with standard errors in parentheses.

[b] Model 1 reports coefficients estimated from seven separate regressions, each of which contained the control variables and one HRM practice variable. "Yes" means that the indicated variable was included in each model 1 regression equation. "No" means that the variable was not included in the referenced equation.

[c] These statistics (joint *F*-tests) reflect the incremental variance accounted for when the staffing selectivity through vertical hierarchy variables are added to the complete specification for each model.

[d] These statistics (joint-*F*-tests) reflect the incremental variance accounted for when the interaction terms are added to the complete specification for each model.

† $p < .10$, one-tailed test

* $p < .05$, one-tailed test

** $p < .01$, one-tailed test

market and vertical hierarchy variables are used as alternate measures of the same construct. The overall model is always statistically significant, and joint-*F* tests indicate that the HRM practices jointly explain a significant amount of the variance in perceived organizational performance. These results show that five of the six HRM practice coefficients in each equation are positive and three (those on training, incentive compensation, and vertical hierarchy) are statistically significant. The HRM practice coefficients are smaller in models 2 and 3 than in model 1, suggesting that the results obtained in analyses focusing on individual HRM practices overstate the effects. Indeed, the decentralized decision making and grievance procedure coefficients become insignificant when entered with the other HRM practice variables.

Table 4 presents results for the perceived market performance dependent variable in a format identical to that used in Table 3. The Table 4 findings are similar to those described above. For example, the coefficients on five of the seven HRM practices are positive and significant when the variables are entered individually into the regression (model 6). At least two of the HRM practice coefficients retain their statistical significance in models 7 and 8. In addition, the coefficients on the HRM practice variables are smaller when the variables are entered together than when they are entered individually. In general, the results in Tables 3 and 4 generally suggest that HRM practices are positively associated with perceptions of performance, consistent with Hypothesis 1.

Hypothesis 2 concerns the potential for complementarities among HRM practices. The first variable we constructed to evaluate this hypothesis indicated the number of HRM practices for which a firm was above the sample

TABLE 4
Results of Regression Analyses for Perceived Market Performance[a]

Variable	Model 6[b]	Model 7	Model 8	Model 9	Model 10
Constant	Yes	3.429**	3.517**	2.628**	3.960**
		(0.512)	(0.440)	(1.098)	(0.723)
Staffing selectivity	0.169**	0.145**	0.147**	0.131*	0.139*
	(0.055)	(0.057)	(0.057)	(0.059)	(0.058)
Training	0.114*	0.073	0.076*	0.071	0.082†
	(0.057)	(0.060)	(0.058)	(0.060)	(0.059)
Incentive compensation	0.149*	0.125†	0.134*	0.123	0.146†
	(0.081)	(0.081)	(0.081)	(0.108)	(0.107)
Grievance procedure	0.083	0.034	−0.034	0.043	−0.111
	(0.104)	(0.105)	(0.104)	(0.459)	(0.458)
Decentralized decision making	−0.047	−0.071	−0.071	0.162	−0.192
	(0.061)	(0.061)	(0.061)	(0.294)	(0.167)
Internal labor market	0.292*	0.134	No	0.588†	No
	(0.161)	(0.167)		(0.566)	
Vertical hierarchy	0.126†	No	0.099	No	−0.134
	(0.082)		(0.082)		(0.320)
Training × staffing	No	No	No	0.080	0.069
				(0.066)	(0.066)
Grievance × incentive compensation	No	No	No	0.001	−0.029
				(0.162)	(0.161)
Internal labor market × decentralized decision making	No	No	No	−0.132	No
				(0.164)	
Vertical hierarchy × decentralized decision making	No	No	No	No	0.066
					(0.083)
Subsidiary	Yes	−0.047	−0.063	−0.066	−0.087
		(0.106)	(0.101)	(0.108)	(0.104)
Log of total employment	Yes	0.004	−0.004	0.008	−0.007
		(0.038)	(0.039)	(0.039)	(0.040)
Log of firm age	Yes	−0.132**	−0.129**	−0.136**	−0.130**
		(0.037)	(0.037)	(0.037)	(0.037)
Percent managers	Yes	−0.522**	−0.529**	−0.528**	−0.604**
		(0.179)	(0.177)	(0.190)	(0.186)
Union pressure	Yes	−0.050	−0.049	−0.047	−0.051
		(0.094)	(0.094)	(0.100)	(0.099)
Product	Yes	0.209†	0.193†	0.191†	0.191†
		(0.147)	(0.145)	(0.148)	(0.146)
Service	Yes	0.132	0.111	0.121	0.091
		(0.125)	(0.125)	(0.125)	(0.126)
Competitive pressure	Yes	−0.214**	−0.217**	−0.209**	−0.217**
		(0.082)	(0.082)	(0.082)	(0.082)
SIC industry dummies	Yes	Yes	Yes	Yes	Yes
R^2		0.263	0.265	0.267	0.269
F		2.466**	2.489**	2.349**	2.373**
ΔR^2		0.037	0.039	0.004	0.005

TABLE 4 (continued)

Variable	Model 6[b]	Model 7	Model 8	Model 9	Model 10
F for ΔR^2		2.703*[c]	2.489*[c]	0.640[d]	0.665[d]
N	373	373	373	373	373

[a] Unstandardized regression coefficients are reported, with standard errors in parentheses.

[b] Model 6 reports results estimated from seven separate regressions, each of which contained the control variables and one HRM practice variable. "Yes" means that the indicated variable was included in each model 1 regression equation. "No" means that the variable was not included in the referenced equation.

[c] These statistics (joint F-tests) reflect the incremental variance accounted for when the staffing selectivity through vertical hierarchy variables are added to the complete specification for each model.

[d] These statistics (joint-F-tests) reflect the incremental variance accounted for when the interaction terms are added to the complete specification for each model.

† $p < .10$, one-tailed test

* $p < .05$, one-tailed test

** $p < .01$, one-tailed test

median. In an analysis (results not shown) that controlled for all of the other HRM practices, we found this variable to be consistently positive but insignificant for each dependent variable. In addition, various transformations of this scale (including individual dummy variables indicating whether each practice was above the sample median, and a spline function to capture any nonlinearities in the relationship) did not improve the explanatory power of this model for either dependent variable.

The second complementarity test we conducted focused on interactions among the HRM practice variables. The extreme degree of multicollinearity among the interactions precluded our simultaneously evaluating them all. Moreover, given the exploratory nature of this research, we experimented extensively with subsets of interactions, both within each HRM practice category (employee skills, motivation, and the structure of jobs and work) and between the categories. Coefficients on interactions were insignificant in nearly all of the models we evaluated. For example, models 4 and 5 in Table 3 and 9 and 10 in Table 4 report two-way interactions within conceptual groupings of variables. The interaction between training and selective staffing has a positive and marginally significant coefficient in model 5, but all other interactions are insignificant. Joint-F tests indicate that addition of the group of interactions did not significantly raise the amount of variance explained in the overall model in any case. We found little evidence of complementarity among HRM practices in the NOS data.

DISCUSSION AND CONCLUSIONS

It has been long and widely asserted that people are the preeminent organizational resource and the key to achieving outstanding performance (Peters & Waterman, 1982; Pfeffer, 1994). Until recently, this assertion was largely a statement of faith. Our results add to the growing empirical evidence suggesting that such assertions are credible (cf. Arthur, 1994; Huselid, 1995; Huselid & Becker, 1994; Ichniowski et al., 1994; MacDuffie, 1995). Overall, and in support of Hypothesis 1, our results suggest that progressive HRM practices, including selectivity in staffing, training, and incentive compensation, are positively related to perceptual measures of organizational performance. Our confidence in the results is bolstered by the nature of the NOS, which is a national equiprobability sample of a wide variety of organizations. Further, our results were robust to a variety of model specifications. For example, subgroup analyses (available upon request) indicated that the effect of progressive HRM practices is similar in for-profit and nonprofit organizations. We take this as evidence of the generality of the progressive HRM practice–firm performance linkage.

Our results do not support the assertion that complementarities among HRM practices enhance firm performance, contrary to Hypothesis 2. Given that we could not measure complementarity between firms' strategies and HRM practices and that our measures of complementarity among HRM practices were crude, however, we cannot say whether our results were a product of poor measures of this construct or the absence of its impact in the sample. In either case, the development of reliable and valid measures of progressive HRM practices and complementarities among these practices remains a critical issue for researchers to address.

Several limitations suggest that our assessments be viewed cautiously. First, the NOS data required us to rely on perceptual measures of organizational performance. Although financial measures of firm performance are more desirable, perceptual measures are regularly used in research, and our results are generally consistent with the findings of studies that used objective performance measures (cf. Huselid, 1995). More important, the use of perceptual measures of firm performance allowed us to assess the firm-level impact of progressive HRM practices in firms for which financial measures of performance are generally unavailable (e.g., nonprofit firms).

Second, the measures of progressive HRM practices that can be constructed from the NOS are incomplete. For example, the degree of employee participation, the form and structure of a firm's incentive compensation system (e.g., the proportion of pay at risk), and more detailed information concerning each firm's performance management system would have allowed the construction of a more complete set of HRM practice measures. Because it was not possible to gauge the potential impact of these omitted variables on the results, we relied on the use of control variables to capture any relevant unmeasured organizational characteristics. Given the consistency of our results with those reported in studies specifically designed to test HRM practice-performance links (Huselid, 1995; Huselid & Becker, 1994; Ichniowski et al., 1994), we do not believe this problem to be serious.

Third, the NOS data limitations that constrain our attempts to measure HRM practices precisely hamper substantially our efforts to construct complementarity measures. Indeed, the disappointing results for our tests of complementarity may be due to the limits of the data and measures rather than to the absence of a complementarity effect. We are unable to distinguish between these possibilities. To avoid this problem in future research, we suggest the collection of information on HRM practices at a level of detail that permits the determination of whether specific practices are consistent or inconsistent with each other. This may mean that researchers should initially conduct industry-level (see Ichniowski et al., 1994) or case studies to identify consistent and inconsistent HRM patterns.

Fourth, common method variance is a potential problem whenever data are collected from a single source. The issue is magnified by the perceptual nature of our dependent variables because managers who report the use of progressive HRM practices (which are said to improve performance by the business press) may also report good organizational performance. We believe that the extent of this problem was reduced by the careful way that the NOS data were collected. For example, most of the HRM practice measures we employed were based on informants' responses to factual questions, and the dependent variables were highly reliable indexes of their perceptions of organizational performance on several different dimensions. In addition, inclusion of wide-ranging control variables—both perceptual and factual—produced little variation in the patterns of results.

Fifth, there is the potential for simultaneity between HRM practices and perceptions of organizational performance in our results. If more profitable firms systematically adopt progressive HRM practices, then our cross-sectional estimates would be overstated. As it was not possible to correct for such endogeneity (appropriate instrumental variables were unavailable), our analyses do not support direct causal attributions. At the same time, the consistency of our results with recent related work providing explicit corrections for simultaneity bias (Huselid, 1995; Huselid & Becker, 1994) raises our confidence in the results of this study.

Data limitations aside, our analyses suggest three main observations. First, consistent with earlier research (Ichniowski et al., 1994), our results indicate that an evaluation of individual HRM practices in isolation is likely to lead to biased estimates of their effects. When HRM practice measures were entered individually in our analyses, their estimated coefficients were always larger (often substantially larger) than their coefficients in models containing other HRM practice measures. Future studies that fail to address this issue should be interpreted cautiously.

Second, increasing interest in the firm-level effects of HRM practices is a very positive development for the human resources field. The complexity of the subject requires the integration of micro-level and macro-level conceptual and empirical frameworks from diverse disciplines, as well as the strategy, leadership, and management literatures more generally. Multidisciplinary discussion and exchange among scholars can only serve to produce research that is better and more relevant to practitioners.

Third, as scholars place more emphasis on the links between HRM practices and firm performance and study them from different perspectives, there is a critical need for consensus concerning the measurement of HRM practices and systems. To date, the relevant literature is distinguished by the fact that virtually no two studies measure HRM practices in the same way. In addition, few studies have considered important related issues, such as whether firms implement HRM practices effectively (Huselid, Jackson, & Schuler, in press). As a result, we see the development of reliable and valid measures of HRM systems to be one of the primary challenges (and opportunities) for scholars interested in advancing this line of research.

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EARLY RETIREMENT PROGRAMS AND FIRM PERFORMANCE

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Early retirement programs are increasingly used as a human resources strategic response to changes in the business environment. For the period 1982–92, we found that investors tended to view early retirement programs favorably. These positive market responses further appeared to be influenced by the institutional rationale for a workforce reduction, the timing of a reduction's announcement, firm size, the restriction of an early retirement program to white-collar employees, and the physical size of the public announcements of a program.

Companies increasingly trimmed their workforces in the late 1980s and early 1990s through various means, such as attrition, layoffs, plant closures, and early retirement programs. Firms with upward-sloping age-earnings profiles may favor mandatory retirement policies (Lazear, 1991). However, now that such retirements have been largely abolished in the United States, offering early retirement is an increasingly popular way to terminate the "lifetime" wage contract between employer and employee. Because companies traditionally pay older employees more than younger ones, and older workers' rate of pay may not be congruent with their current productivity (Lazear, 1978), losing older workers through early retirement may save money. In contrast, firms that use slow-acting natural attrition may have to continue to pay employees who are no longer needed (Greenhalgh, Lawrence, & Sutton, 1988). Layoffs and plant closing strategies enable firms to carry out large-scale employee reductions, but they often lead to dysfunctional consequences for "outplaced" and surviving employees (Brockner, Greenberg, Brockner, Bortz, Davy, & Carter, 1986; Flaim & Sehgal, 1985; Kinicki, 1985).

Although firms that reshape their workforces through early retirement have a good chance to be more profitable, early retirement programs can backfire. A myriad of both individual-level "push" factors, such as attitudes toward retirement, work history, and health status, and "pull" factors such as leisure, alternative employment, and expected pension wealth enter into older workers' decisions about the desirability of early retirement (Allen & Clark, 1986; Feldman, 1994). These may lead to adverse selection issues such as not enough or too many people leaving, and sometimes to the perverse effect of the worst people staying and the best ones leaving. We observed the net market reaction effect.

RESEARCH ISSUES

Prior research has examined personal traits associated with early retirees (e.g., Howard, 1988), types of jobs linked with early retirement (e.g., Filer & Petri, 1988), and personnel policies that have encouraged employees to take retirement (e.g., Ippolito, 1990). Little empirical research has focused on either the financial considerations of such plans for a firm and its shareholders or on the characteristics of firms that initiate these programs. Early retirement programs involve large up-front investments with possible future financial benefits such as reduced labor costs. They can be viewed in the same way as other financial decisions involving potential changes in current and future cash flows. The stock market's reaction to the announcement of such a program shows how investors perceive it. Stock market reactions depend on investors' perceptions of an event's positive or negative effects on the value of a firm (Fama, 1970, 1991). We can interpret a market reaction to these announcements as investors' unbiased estimate of the announcement's incremental effect on firm financial performance.

Desired Financial Consequences

Some firms may use early retirement programs when they have undergone significant deterioration in their financial performance.[1] Others may also choose to adopt such plans to maintain or to enhance their competitive positions. Whether the early retirement program is the result of a cost-cutting scheme that is a reaction to falling financial performance or a proactive measure designed to improve an already strong position, we assume the primary desired consequence is improving the company's financial position.

Observers of a firm may see using early retirement programs as a strategy for increasing organizational viability and as a step toward organizational change and regained effectiveness (Weitzel & Jonsson, 1989). Stock market investors may view such a program as needed to reduce payroll costs and induce future efficiencies. Morse and Shaw (1988) found that positive stock returns followed the announcements of reorganization plans. If managers are undertaking early retirement programs to improve performance, then the market will likely react positively. Hence,

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[1] In our sample, the profit margin decreased from an average of 6.89 percent two years before an announcement to 2.37 percent in the year of the announcement. This decrease is significant at better than .01 using an *F*-statistic. Similarly, there was a significant drop in the return on equity and an insignificant increase in the debt-to-asset ratio during this two-year period. On average, these firms announcing early retirement programs experienced deteriorating prior financial performance.

> *Hypothesis 1: The stock market will generally respond positively to the announcement of an early retirement program.*

Institutional Rationale

Early retirement plans may occur for different reasons, and their announcements may elicit varied market reactions depending upon the perceived institutional rationale for the workforce reductions. The market, for example, might be sensitive to whether the program is part of an overall strategy to create real value or a shorter-sighted cost-cutting effort. Hamel and Prahalad (1994) noted that too often in downsizing, the urgent drives out the important when firms, via aggressive "denominator management," get smaller faster than they get better. Important core competencies may be cut, and competitiveness may be done as much harm as good. "Corporate anorexia" (Wysocki, 1995) may develop, with a company so hooked on slashing costs that it starves remaining infrastructure.

Building on previous models of organizational change (Pettigrew, 1985; Tushman & Romanelli, 1985), Cameron (1994), Freeman and Cameron (1993), and Freeman (1994) suggested that organizational downsizing is either "reorientation" or "convergence." Convergence downsizing is more of a defensive reaction to decline, focusing on internal efficiency through cost cutting, whereby a firm tries to do the same things better with fewer employees. Downsizing as reorientation, however, may be seen as a more proactive approach; the firm seeks to do different things, and it engages in more radical change requiring rethinking its primary mission, strategy, processes, and structure. Firms may also employ some type of hybrid approach when facing the need for large-scale downsizing (Freeman, 1994).

Institutional rationales for implementing early retirement programs can vary considerably, and the market may well be sensitive to the reasons for downsizings. Examining announcements of early retirement programs made it clear that if a reason was provided, it typically was either cost cutting in response to decline, or broader corporate restructuring. In cases of decline that continue to worsen, firms may at some point not even be able to recover (Weitzel & Jonsson, 1989). Here it can be argued that the closer a firm moves toward financial ruin, announcements of continued cost-cutting strategies such as downsizing may signal the market that it is still in decline and may be in an even worse condition than previously. In contrast, early retirement program announcements not made during periods of decline may signal a firm reorientation rather than just a reduction in employee head count. Hence,

> *Hypothesis 2: Firms that are not in decline and are adopting early retirement programs will demonstrate more positive abnormal returns than those adopting such programs as a cost-cutting measure during decline.*

Percentage of Employees Impacted

Early retirement programs often affect a large number of employees. For example, in the fall of 1986, Cummings Engine Company offered an early retirement program to 17 percent of its workforce (*Wall Street Journal*, 1986). The market's response to such an announcement should be much more pronounced than it would be if the program were offered to fewer employees. If early retirement program announcements are positive signals, those offered to high percentages of employees should convey more positive information than smaller ones. The more employees involved, the greater the cost-cutting potential will be. Worrell, Davidson, and Sharma (1991) reported that announcements of large layoffs elicited stronger market responses. Thus,

> *Hypothesis 3: Abnormal returns will be positively related to the percentage of employees offered an early retirement program.*

METHODS

Sample

We found announcements in the *Los Angeles Times, Wall Street Journal, Washington Post,* and *New York Times* using the DIALOG system of the National Newspaper Index for the years 1982 through 1992. We initially found 83 announcements for this time period. To use the daily return Center for Research in Security Prices (CRSP) tapes from the University of Chicago, we removed companies not publicly traded on either the New York or American Stock Exchange. Further, we eliminated first announcements that told of the results of an already completed early retirement program and those that were contaminated with other contemporaneous company information. The final sample included 51 annoucements of early retirement programs.

Data Analysis

The major focus of this research was to determine market reactions to announcements of early retirement programs using standard event methodology. Since this procedure is widely used by researchers, we only summarize it here. A regression equation of daily stock returns against the return on a market index becomes the predictive model used to predict normal returns around announcements. The difference between the actual and the normal returns is a security's prediction error, or abnormal return. We averaged these on each day in the test interval and also accumulated them over various intervals to provide mean cumulative abnormal returns (CARs). A CAR should be zero unless investors receive information that affects the intrinsic value of a stock. We used Dodd and Warner's (1983) test statistic, Z, to determine if the CARs differed from zero. Further details on this methodology are available from the authors upon request.

Defining day 0 as the announcement day, we regressed the CARs over days -5 to -2, the interval in which the largest stock market reaction occurred, against the three variables measuring prior performance: CARs from days -240 to -20, the profit margin in year 0, and the change in the profit margin from years -2 to 0. We used the cost-cutting dummy variable, the percentage of employees involved, and firm size as independent variables.

Measures

Prior firm performance. We assessed prior firm performance using several measures. First, we examined each firm's income statement and computed its profit margin (net income divided by net sales revenue) in the year of the early retirement program's announcement (year 0) and for two years prior to the announcement (year −2). Our second measure of prior firm performance was abnormal stock returns in the year preceding the announcement of the early retirement program. These abnormal returns were measured over the period days −240 to −20. Thirty of the 51 firms experienced negative CARs during this period. It is implicit in this measure that poor prior financial performance will negatively affect a firm's stock prices.

Institutional rationale. Here, we examined the collected news stories to find the stated reasons for the early retirement programs. We found two major categories: cost cutting and reorienting. As shown in Table 1, 31 of the firms specifically indicated cost cutting as their motive. In some of our statistical tests, we included a dummy variable taking the value of 1 when a firm stated cost cutting as a motive. Our second way to test institutional rationale was to compare the abnormal returns to the above-discussed measures of prior firm performance. Firms performing poorly may be motivated to make more

TABLE 1
Early Retirement Company Statistics[a]

Characteristics	Mean	Maximum	Minimum	Number
Panel A data				
Percentage of employees involved[b]	2.93	33.0	0.0	
Year 0 sales	19,383,210	132,242,200	22,492	
Year 0 market value of equity[c]	12,592,220	81,936,360	311,295	
Year 0 debt-to-asset ratio	60.7	134.7	12.2	
Number of employees in firm	71,474	370,400	3,304	
Panel B data				
Size of article				
4 inch				4
3 inch				16
2 inch				17
1 inch				14
Program restricted to white-collar employees				24
Cost cutting claimed as motive				31
Union representative on board				1
Negative CAR on days −240 to −20				30
Contemporaneous programs to cut costs or restructure				21

[a] $n = 51$ for both panels.
[b] Number of firms with less than 1 percent involved 26 of 51.
[c] Expressed in thousands of dollars.

drastic changes. Finally, we tested the institutional rationale by dividing our sample into two equal groups based on announcement timing. Half of the sample announced the programs prior to January 30, 1987, and half announced them later. Prior to this date, the economy was in the midst of the Reagan boom years, which were followed by the relatively stagnant Bush years (Nemec, 1995). Firms announcing early retirement programs in a good economic climate may be demonstrating a commitment to growth, but those announcing in a poor climate may just be making short-sighted attempts to cut costs.

Percentage of employees offered the program. To test Hypothesis 3, we included a variable measuring the percentage of employees eligible for an announced program. As Table 1 shows, the average percentage of eligible employees was 2.93 percent, but this statistic ranged from small programs that rounded to 0 percent up to those including 33 percent of a firm's employees.

Control variables. The market may also respond differently to announcements concerning different types of targeted employee. Freeman and Cameron (1993) noted that the white-collar workforce has recently been hit hard by downsizing. This severity is due in large part to the earlier explosion in the numbers of nonproduction workers (Tomasko, 1987) and to the fact that so many blue-collar workers were displaced after the economic slowdown in the early 1980s (Bednarzik, 1983). Although investors may have viewed such early blue-collar worker displacements as positive firm responses to recessionary and competitive pressures (Flaim & Sehgal, 1985), later negative stockholder reactions could also have been possible. Thurow (1985) pointed out that between 1978 and 1984 white-collar employment actually rose by 21.5 percent, and productivity fell by 7.5 percent. He argued that blue-collar output per hour of work rose more than 20 percent during this period and that real productivity gains could be made by cutting these huge white-collar staffs, rather than by making further reductions on the factory floor. Excess white-collar workers thus may be seen as a source of U.S. noncompetitiveness. We read the news stories surrounding the early retirement announcements to determine if the programs were restricted to white-collar or nonunion employees. As Table 1 shows, 24 of the 51 sample firms restricted their programs to white-collar employees. To control for any confounding effects, we statistically compared the stock returns of the white-collar-only programs to those of the unrestricted programs.

The size of a firm has been shown in numerous studies to affect stock returns. A summary of this research appears in Copeland and Weston (1992). Although we do not provide specific hypotheses concerning firm size, we controlled for it in our regressions by using the natural logarithm of the market value of firm equity as an independent variable.

We also controlled for the physical size of the printed annoucements. Advertising research (Gronhaug, Kuitastein, & Gronomo, 1991; Kaplan, Aamodt, & Wilk, 1991) has shown that the physical size of an advertisement influences readers' perceptions. By extension, the size of an early retirement program announcement may affect the number of investors aware of a program, how serious the company is about cost cutting, and how crucial investors perceive the program to be. We read each early retirement announcement and categorized it in terms of size using a scale of 1 to 4, with 1 being very small (one column, about one inch long, small print), and 4 being very large (several columns with a larger, dark headline).

RESULTS

Cumulative Abnormal Return Results

The event study results appear in Table 2. On days −1 and 0, the CARs were statistically insignificant. However, on the days immediately leading up to an announcement, over the interval −5 to −2, the CAR is 0.78 ($Z = 2.01$, $p < .05$), and the CAR over the interval −20 to −1 is 0.92 ($Z = 1.73$, $p < .10$), which is marginally significant. Even though the CAR for −20 to −1 is significant, most of the reaction takes place during −5 to −2, which is encompassed by the longer interval. Hence, we focus on the interval between day −5 and day −2. Most of the market's reaction occurs in this period, which is approximately the week prior to an announcement. These results suggest that the market received the news just prior to the public announcement and reacted positively. These findings are consistent with Hypothesis 1.

Cross-Sectional Results

As we show in Table 3, we divided the sample in several ways. First, we grouped the firms announcing cost cutting and those not stating cost cutting as a motive and found that the CARs over the interval day −5 to day −2 were not different. Similarly, we grouped the firms in which the

TABLE 2
Cumulative Abnormal Returns for Intervals Surrounding the Announcements of Early Retirement Programs

Days	CAR	Z	Positive/Negative[b]
−240 to −20	−6.83%	−2.37*	22/32
−90 to −1	−1.68	−0.91	23/31
−20 to −1	0.92	1.73†	32/22
−5 to −2[a]	0.78	2.01*	38/16†
−1	−0.23	−1.22	24/30
0	0.05	0.31	23/31
1	−0.21	−1.11	22/32
1 to 20	0.74	1.36	27/27
1 to 90	1.18	0.64	28/26
20 to 240	0.53	0.19	26/27
241 to 460	6.44	2.24*	31/21

[a] We computed the dollar value of the CAR for the interval day −5 to day −2 by multiplying the market value of the equity for each firm by each firm's CAR. The average dollar value was $98,219,316, which translates to $46,905 per employee offered the chance to retire early.

[b] The numbers of positive and negative CARs are shown. A binominal test of significance shows the number of positive CARs is significantly greater than chance over the interval days −5 to −2.

† $p < .10$

* $p < .05$

TABLE 3
Results of Pairwise Comparison

		Two-Sample Comparison Statistic		
Variables	***n***	**CAR$_{-5 \text{ to } -2}$**[a]	***t***	**Mann-Whitney *Z***
Cost-cutting firms	31	0.86 (1.30)	0.04	0.19
Non–cost-cutting firms	20	0.82 (1.27)		
Part of overall plan	27	0.30 (0.42)	−0.96	−0.66
Not part of overall plan	24	1.22 (1.95†)		
Announced before 1/30/87	25	1.52 (2.25*)	1.42	1.08
Announced after 1/30/87	26	0.19 (0.30)		
Not restricted to white-collar employees	27	0.11 (0.18)	−1.67†	−1.51
Restricted to white-collar employees	24	1.66 (2.48*)		
CAR$_{-240 \text{ to } -20} > 0$	21	1.36 (3.05**)	1.36	1.83†
CAR$_{-240 \text{ to } -20} < 0$	30	0.30 (0.48)		

[a] Values in parentheses are *Z*-scores.
† $p < .10$
* $p < .05$
** $p < .01$

announcement stated that the program was either part of or not part of an overall plan and compared the CARs. Those not part of a plan had a CAR$_{-5 \text{ to } -2}$ of 1.22 percent ($Z = 1.95$), which is only marginally significant. However, the means of the two groups are not significantly different ($t = -0.96$). These results do not support Hypothesis 2.

We also conducted pairwise comparisons of the values for CAR$_{-5 \text{ to } -2}$ based upon announcement timing. Twenty-five announcements occurred before January 30, 1987, and they had a CAR of 1.52 percent ($Z = 2.25$, $p < .05$). For the 26 firms announcing early retirement programs after that date, the CAR$_{-5 \text{ to } -2}$ is only 0.19 percent ($Z = 0.30$) and is insignificant. Comparing these means produces a *t*-statistic of 1.42, which is insignificant at conventional levels. These results lend some support to Hypothesis 2. Since the earlier time period was characterized by better economic conditions, the firms were less likely to be seen by the market as in economic decline.

There were 21 firms with positive CARs over the interval −240 to −20, and this CAR$_{-5 \text{ to } -2}$ is 1.36. For the firms with negative CARs over days −240 to −20, the average $CAR_{-5 \text{ to } -2}$ is only 0.30. The *t*-statistic comparing the two groups is insignificant, but the nonparametric test result is 1.83 and is marginally significant ($p < .10$). Thus, consistent with Hypothesis 2, the market reacted more positively for firms performing well prior to the announcements.

Finally, 24 firms restricted this programs to white-collar or nonunion employees. These firms had an average $CAR_{-5 \text{ to } -2}$ of 1.66 ($Z = 2.48$, $p < .05$). The unrestricted programs have an average $CAR_{-5 \text{ to } -2}$ of 0.11, which is insignificant ($Z = 0.18$). Comparing them produces a *t*-statistic of −1.67, which is marginally significant ($p < .10$). Thus, plans restricted to white-collar employees produced more positive announcement period results.[2]

We regressed (Table 4) each individual firm's CAR against several explanatory variables. We first regressed each independent variable against the CAR on the period from 5 to 2 days prior to announcement. None of these variables individually has significant explanatory power at the .05 level, but three are significant at 0.10: the size of the article containing the announcement, the logarithm of the market value of equity, and the dummy variable taking the value of 1 if the program is not restricted to white-collar employees. Inconsistent with Hypothesis 3, the abnormal returns were not significantly related to the number of employees offered the plan.

If more than one of the independent variables are allowed to enter the model simultaneously, two of the three variables are still significant: article size and market value of equity; the percentage change in the profit margin from year −2 to year 0 is also significant. Models 11 and 12 used different combinations of variables, but both regressions have highly significant *F*s. Model 11 has an adjusted R^2 of 25.41 percent, and the R^2 for model 12 is 29.32 percent.

The sign of the coefficient for the percentage change in profit margin is positive and is significant at better than .10 ($t = 1.93$ in model 12). The larger a positive change in a profit margin, the more positive the market's reaction over the interval −5 to −2. Similarly, in model 12, the coefficient for article size is positive and highly significant ($t = 3.30$, $p < .01$). The larger the size of an announcement, the more positive the market's reaction to it. Finally, we controlled for firm size. The coefficient for the logarithm of the market value of equity is negative ($t = -2.99$, $p < .01$). This variable is the firm's stock price times the number of shares outstanding at the end of the month prior to the early retirement announcement. Its negative sign implies that the stock price reaction was more positive for small firms than for large firms.

Postperiod Results

Table 2 shows the CARs for the period days 20 to 240 and for days 241 to 460. These periods each represent approximately one year in trading days.

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[2] Future research in this area may want to reexamine the white-collar, blue-collar issue. For example, white-collar programs may be viewed more or less positively if all previous employee-reduction plans were restricted to blue-collar employees.

TABLE 4
Results of Cross-Sectional Regression Analysis

Model	Intercept[a]	Profit Margin, Year 0[a]	Percent Change in Profit Margin, Year −2 to 0[a]	Percentage of Employees Involved[a]	Article Size[a]	Market Value of Equity[a,b]	Before 1/30/87[a]	Not Restricted to White Collar[a]	Cost Cutting[a]	Part of Plan[a]	CAR −240 to 0[a]	Adjusted R^2[c]
1	0.6988	6.0768										2.47
	(1.47)	(1.51)										(2.27)
2	0.9287		0.1703									0.00
	(1.92†)		(0.85)									(0.72)
3	0.4107			0.1477								1.39
	(0.72)			(1.31)								(1.71)
4	−1.0841				0.8855							4.38
	(−0.94)				(1.81†)							(3.29†)
5	10.2372					−0.6043						3.85
	(1.88†)					(−1.73†)						(3.00†)
6	0.1942						1.3238					1.99
	(0.30)						(1.42)					(2.01)
7	1.6638							−1.5500				3.47
	(2.47*)							(−1.68†)				(2.82†)
8	0.8175								−0.0421			0.00
	(1.08)								(0.04)			(0.00)
9	1.2233									−0.9233		0.00
	(1.99†)									(0.96)		(0.93)
10	0.9002										0.0065	0.00
	(1.99†)										(0.42)	(0.17)
11	16.5917	5.8711	0.3441	0.0127	1.4772	−1.1000	1.3527	−0.2640				25.41%
	(2.81**)	(1.50)	(1.91†)	(0.12)	(3.09**)	(−2.81**)	(1.51)	(−0.29)				(3.21**)
12	16.9101	6.1001	0.3470		1.5180	−1.1371	1.4129					29.32%
	(3.11**)	(1.64)	(1.93†)		(3.30**)	(−2.99**)	(1.63)					(4.49***)

[a] Values in parentheses are *t*'s.

[b] Value is a logarithm.

[c] Values in parentheses are *F*s.

† $p < .10$

* $p < .05$

** $p < .01$

*** $p < .001$

Over days 20 to 240, the CAR is insignificant. However, it is positive over days 241 to 460, representing the second year after an event.[3]

DISCUSSION

Since the mid 1980s, and as an outgrowth of recessionary pressures (Fluhr, 1989), companies have increasingly used early voluntary retirement programs in response to competitive conditions. We found that early retirement programs are likely to be preceded by deteriorating financial conditions. Couple this with the fact that cost cutting is commonly given as a reason for early retirement programs and a story of decline and an accompanying human resource strategy of reaction to decline emerges.

Because the success of strategic human resource management policies is increasingly measured in financial terms (Martell & Carroll, 1995; Walker & Bechet, 1991), for an early retirement program to be seen as effective it must positively affect a firm's bottom line. Announcements of early retirement programs have implications for a corporation's employees and for the corporation itself and, by extension for its shareholders. We found that investors respond favorably to the offer of an early retirement program.[4] This response comes immediately prior to the public announcement of the plan. Although a firm, through its announced buyouts, increases the number of retiring employees and thus pension benefits, investors likely view declines in long-term head counts (payroll costs) as more favorable.

As the time elapsed from the announcement of an early retirement program increases, problems in attributing causation and in controlling for other factors also increase, but we did find positive market reactions two years after announcements (days 241 to 460). Favorable market perceptions may thus not just be temporary. Drawing on a review of prior empirical research and new results from a national sample, Huselid (1995) reported that the use of effective human resource management practices is associated with improvements in both short- and long-term measures of corporate financial performance. Cameron (1994) similarly argued that some downsizing efforts may be quick-hit cuts that generate immediate bottom-line improvement and that others may involve more systematic programs that have longer-term payoffs.

These findings of positive market reactions, however, could be misleading if not taken further. The impression could be that staff cuts are good and more is better and that every firm should announce an early retirement program. Taken to a logical extreme, our findings might be perceived as advising firms to encourage almost all older workers to retire early. Wholesale abandonment of the old implicit social contract between employer and employee, however, would likely leave many continuing employees feeling betrayed and experiencing reduced incentive for organizational loyalty (Brockner et al., 1986).

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[3] We attempted numerous tests to determine which groups of firms improved the most in the postannouncement period. These tests produced insignificant results.

[4] In our sample the mean year 0 profit margin increased from 2.37 to 3.38 percent in the year after an announcement. The return on equity also increased, on the average, for our sample firms. Thus, the human resources response to deteriorating financial conditions seems to be effective in improving the bottom line.

The firms in our sample were, on the average, firms with decreasing prior performance, but this fact did not seem to impact the announcement period returns in the way we hypothesized. For example, one of the most interesting findings was that although there were no significant market reactions for those firms that were in decline the year before the announcement of their early retirement programs ($CAR_{-240 \text{ to } -20} < 0$), for those whose prior year's performance was good ($CAR_{-240 \text{ to } -20} > 0$), there was a significant positive market response. Consistent with the discussion above, however, there are also likely limits to the upside benefits of early retirements even for these successful firms. Also, the lack of a "kick" for the poor performers provides an interesting counterpoint to the popular notion that failing firms are saving themselves on the backs of the workforce. Future researchers may want to examine the relationship between early retirement programs, their success, worker productivity, and firm age-earnings profiles. These findings are also consistent with the notion that the market may be sensitive to perceived institutional rationales for implementing early retirement programs (Cameron, 1994; Freeman, 1994; Freeman & Cameron, 1993). Proactive downsizing made when a firm is doing well may signal an intended reorientation of personnel that goes well beyond a mere defensive reaction to decline through cost cutting.

Direct examination of whether the news stories identified cost cutting as a reason for the implementation of the early retirement programs or indicated whether the early retirement programs were part of an overall strategy failed, however, to reveal any significant differences. Investors' greater focus on less filtered, tangible factors, such as a firm's prior performance, may in part explain this absence of significance. Freeman and Cameron (1993: 14) noted that downsizing is evidenced in behaviors and activities and goes beyond inferring intentions and post hoc rationalizations by managers. Emergent strategies are not necessarily the same as those that are deliberate (Mintzberg & Waters, 1985), and assessing managerial intentions is open to considerable error.

We also found some evidence of other influences on market reactions: the timing of the announcements relative to the broader business cycle, whether the announcements were limited to white-collar workers, firm size, and the physical size of the article containing an announcement. Announcements made between 1982 and January 30, 1987, were met by significant, positive investor reactions. This was a period of substantial economic growth whose robust overall business climate may have promoted a rosy economic glow that permeated investor perceptions of organizational downsizing efforts. The market also responded more favorably to announcements that were restricted to white-collar employees. This finding is consistent with the view that such workers may have been seen as a primary source of noncompetitiveness (Thurow, 1985; Tomasko, 1987). Although abnormal returns were not found to be significantly related to the percentage of employees offered early retirement, more positive market reactions were found for smaller firms that announced such plans.[5] These firms may have been viewed as still being small enough that a workforce reduction could make a difference. Finally, the market also appeared to respond more favorably to physically larger announcement articles. Investors need to be aware of an early retirement program in order to respond, and the amount of press coverage may provide them with an indication of the seriousness of a firms' actions.

Several caveats should, however, be noted. First, the total usable sample from our 11-year window of 1982 through 1992 was 51 firms. Given continuing downsizing, subsequent studies should be able to compile larger samples. Second, our study focuses primarily on the immediate response of the stock market. Over the long term, however, many confounding variables affect the market evaluation of firms, which may limit confidence in any associations found; this is especially true if accounting data are employed (Lubatkin & Shrives, 1986).

Future research in this area is clearly warranted. Research is needed, for example, to extend Howard's (1988) study into which and how many employees will take early retirement offers. Feder quoted a financial advisor who commented that some early retirement programs are like "driving a bus up to the front door and seeing how many get on" (1991: 10), highlighting the need for research on the determinants of response rates. One survey (*Wall Street Journal,* 1993) of over 1,000 human resource executives revealed that nearly two-thirds of the firms that offered early retirement programs in the past five years lost essential employees. More information is needed on the skill levels, job categories, and geographic regions impacted by such early retirement plans.

Although few CEOs may be as forthright as Robert Goizuela of Coca-Cola, who has been quoted as stating "I get paid to make the owners of the Coca-Cola Co. increasingly wealthy with each passing day . . . everything else is just fluff" (Reese, 1993: 44), recent transitions in corporate governance, including the changing role and composition of boards, the increasing zeal of shareholder activists, and the awakening of institutional investors, have increased firms' responsiveness to shareholders. Adopting early retirement programs appears to be one such human resource strategy.

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[5] It should be noted that "smaller" is used in a relative sense; all firms in the sample were large enough to be traded on either the New York or the American Stock Exchange.

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WHY CROSS-NATIONAL DIFFERENCES IN ROLE OVERLOAD? DON'T OVERLOOK AMBIENT TEMPERATURE!

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The finding that, across nations, power distance (expected and accepted unequal interpersonal influence) is positively related to role overload (Peterson et al., 1995) might be an artifact of the relation between role overload and ambient temperature or other third factors. We related data on power distance and role overload to other data sets, making explicit how much is often *not* considered when countries are compared. Results show a mysterious but unmistakable heat-overload link, which is discussed from both a physiopsychological and an evolutionary cultural perspective.

The increasing globalization of many organizations makes cross-national differences in work environments salient and important. How work is experienced, organized, and performed is a complex function of a country's distinct climate, economy, culture, and so forth. Given this complexity, organizational scholars have to disentangle the influence of a myriad of factors when they want to establish a relation between an aspect of a national labor environment and specific work perceptions or behaviors (Hofstede, 1980, 1991; Lytle, Brett, Barsness, Tinsley, & Janssens, 1995; Triandis, 1994; Wong & Birnbaum-More, 1994).

Against this background, we have taken cognizance of the impressive recent cross-national study of role stresses among middle managers in 21 countries (Peterson, Smith, Akande, Ayestaran, Bochner, Callan, Cho, Jesuino, D'Amorim, Francois, Hofmann, Koopman, Leung, Lim, Mortazavi, Munene, Radford, Ropo, Savage, Setiadi, Sinha, Sorenson, & Viedge, 1995). This project examined the relations between Hofstede's (1980, 1991) cultural dimensions of power distance ("the extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally" [Hofstede, 1991: 28]), individualism, uncertainty avoidance, and masculinity on the one hand, and role stresses

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on the other. Peterson and colleagues concluded that "the power distance and individualism concepts are the ones most closely linked to the role stresses" (1995: 446). The question is, however, whether these two cultural dimensions are the best variables to explain cross-national differences in role stresses. In our view, countries simply differ on too many factors to allow certainty about associations between contextual factors such as power distance and individualism, and dependent variables such as role stresses (cf. Berry, Poortinga, Segall, & Dasen, 1992; Lytle et al., 1995). Although we do not think Peterson and colleagues (1995) would argue that they did capture all the ways in which the 21 countries in their sample differed, the main purpose of the present study is to make explicit just how much researchers often do *not* consider when comparing countries or cultures, including alternative explanations and variables of major importance.

BACKGROUND AND HYPOTHESES

With regard to national rates of experienced role overload we have enough confidence in some theoretical notions and empirical associations to argue that role overload may well be a hidden function of a country's average ambient temperature rather than of power distance and its covariates.[1] Perhaps the main reason the possible link between this climatic condition and role overload has been overlooked is that the relevant literature has focused mainly on more proximal, and thus more obvious, economic, cultural, organizational, occupational, and personal influences on perceptions of work load (e.g., Cammann, Fichman, Jenkins, & Klesh, 1983; Cooper & Payne, 1978; Dompierre, Lavoie, & Perusse, 1993; Kahn, Wolfe, Quinn, Snoek, & Rosenthal, 1964; Peterson et al., 1995; Rousseau, 1977; Shull & McIntyre, 1984). Compared to other potential antecedents of role overload, ambient temperature is of special interest because the direction of causality would be unequivocal: from temperature to role overload and not the reverse. If a link between ambient temperature and role overload were established, it would be necessary and interesting to examine possible mediators of this relationship, including power distance.

An association between ambient temperature and role overload has some intuitive appeal on the basis of people's everyday experience that we work less, and less efficiently, when we feel that it is too hot. According to Myrdal (1968) and Bandyopadhyaya (1978), a tropical climate makes people less inclined to work. Indeed, empirical studies have demonstrated that ambient heat usually reduces a worker's quantitative and qualitative output because he or she cannot get rid of the heat produced by the human body (e.g.,

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[1] "The measures of power distance and individualism are conceptually linked and have a strong negative relationship in the present sample ($r = -.80$)" (Peterson et al., 1995: 435). Indeed, power distance and individualism were equally strongly related to both role overload and role ambiguity, but the relationships were in opposite directions (Peterson et al., 1995: 446, Table 5). In the current article, power distance and individualism, apparent poles of the same dimension, will therefore be represented by power distance only.

Poulton, 1978; Van Dormolen, Hertog, Van Dijk, & Fortuin, 1988). Zajonc (1994) recently uncovered an interesting research-based chain of connections between the nasal intake of hot air, insufficient cooling of arterial blood supplied to the cavernous sinus, insufficient cooling of the hypothalamic temperature, and negative affect.[2] Measures of negative affect exhibit traitlike stability when longer-term instructions are used (e.g., "past year" or "in general"), whereas they are sensitive to fluctuations in mood when short-term instructions are used (e.g., "right now" or "today" [Watson, Clark, & Tellegen, 1988]). Since the traitlike dimension of negative affectivity is positively related to self-reports of job stress, including role overload (e.g., Brief, Burke, George, Robinson, & Webster, 1988; Burke, Brief, & George, 1993), it makes sense to assume that the temperature-based state of negative affect is positively associated with role overload as well.

> *Hypothesis 1: Cross-nationally, ambient temperature is positively related to level of role overload.*

Power distance is already known to be related to the geographical latitude of a country's capital city, a crude measure of ambient cold ($r = -.65$ [Hofstede, 1980] and to the level of role overload ($r = .42$ [Peterson et al., 1995]). Consequently, power distance could be a third variable that leads to the confirmation of Hypothesis 1 on the basis of a spurious correlation, which has to be checked.

> *Hypothesis 2: Cross-nationally, with power distance controlled, ambient temperature is still positively related to level of role overload.*

Support for Hypotheses 1 and 2 would not necessarily imply that the relation between power distance and role overload proposed by Peterson and colleagues (1995) has been disconfirmed. Therefore, to increase our confidence in the validity of the explanation of role overload in terms of ambient temperature rather than power distance, we expected that the following hypothesis would *not* be supported.

> *Hypothesis 3: Cross-nationally, with ambient temperature controlled, power distance is still positively related to level of role overload.*

As stated earlier, the main purpose of the reported study was to make explicit how much researchers often do not consider when comparing countries or cultures. We applaud Lytle and colleagues' (1995) position that it is the cross-national and cross-cultural researcher's task to elaborate a research design by strategically adding dimensions so as to rule out alternative explanations for the predicted effect or effects. Just as Peterson and coauthors overlooked the possible influence of ambient temperature, we could overlook crucial economic, cultural, organizational, occupational, and personal variables that might produce a spurious correlation between ambient temperature and role overload. To reduce the risk of accepting as true a positive temperature-overload relation that is in fact false, we decided to explore whether a heat-overload link, if any, could be an artifact of some third variable other than power distance.

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[2] Whether inhaling extremely cold air also produces negative affect is yet unknown.

MEASURES

The dependent variable for this study was role overload. Peterson and colleagues defined role overload as "an individual's lack of the personal resources needed to fulfill commitments, obligations, or requirements" (1995: 430). We adopted their national scale means for five role overload items, adjusted for personal and organizational characteristics, as the variable to be predicted (for details, see Peterson et al. [1995: 443, Table 3]). It should be noted that this operational definition of the dependent variable restricted our study to 21 nations. The measure ranged from 2.41 in Finland to 3.28 in India ($\bar{x}$ = 2.79; s.d. = .27). Its aggregate reliability, indicating that the between-nations variance exceeded the within-nation variance, was .93.

Average daytime temperature for a country's capital city was chosen as the indicator of ambient temperature, our independent variable. Relying on the sixth edition of the *National Geographic Atlas of the World* (Garver, Payne, & Canby, 1990), we found that this variable ranged from 8.25°C in Finland to 31.83°C in India ($\bar{x}$ = 21.05°C, s.d. = 6.71°C). The ambient temperatures in the other 19 countries are 12.25°C in the Netherlands, 13.67°C in Germany, 14.17°C in the United Kingdom, 15.58°C in France, 16.33°C in Korea, 18.33°C in the United States, 18.67°C in Japan, 19.00°C in Spain, 20.58°C in Portugal, 21.25°C in Australia, 22.33°C in Mexico, 22.42°C in South Africa, 22.75°C in Iran, 24.67°C in Hong Kong–Macao, 26.58°C in Uganda, 27.33°C in Brazil, 30.17°C in Nigeria, 30.33°C in Indonesia, and 31.00°C in Singapore.

Power distance was employed as a control variable. Hofstede's (1991: 26, Table 2.1) power distance scores, indicating to what extent people expect and accept that social dependence relationships are distributed unequally, ranged from 33.00 in Finland to 81.00 in Mexico ($\bar{x}$ = 57.50, s.d. = 16.61). Hofstede's missing value for Uganda could not be replaced by the regional score of East Africa because the latter score refers to Zambia in particular (Van de Vliert, Schwartz, Huismans, Hofstede, & Daan, 1995).

We chose 54 variables as alternative predictors. Each of them met four criteria. First, a cross-national data set was available that overlapped Peterson and colleagues (1995) data set for at least ten countries. Second, the reliability and validity of the measurement of the alternative predictor were adequately addressed by the scholar or scholars who built the data set. Third, unlike Hofstede's (1980) 25-year old indicator of power distance, the alternative predictor had been established recently. Fourth, the alternative predictor seemed potentially relevant to the experience of role overload at work.

RESULTS

Table 1 give correlations among the predictors and the dependent variables as well as the sources of data for all variables.

Validity Checks

Some findings support the validity of Peterson and colleagues' (1995) measure of role overload. As Table 1 shows, role overload was negatively related to harmony ($r = -.65$, $n = 13$, $p < .01$), job satisfaction ($r = -.58$, $n = 17$, $p < .05$), and subjective well-being ($r = -.48$, $n = 17$, $p < .05$). Similarly, Hofstede's (1991) measure of power distance was positively related to centralization ($r = .79$, $n = 10$, $p < .001$).

Tests of Hypotheses

In keeping with Hypothesis 1, ambient temperature appears to be positively related to the national levels of role overload ($r = .56$, $n = 21$, $p < .01$). Additionally, and in agreement with the rationale for Hypothesis 2, power distance is positively related to both temperature ($r = .78$, $n = 20$, $p < .001$) and role overload ($r = .44$, $n = 20$, $p < .05$). Given the supposed one-way direction of causality, this pattern of positive intercorrelations means that ambient temperature influences both power distance and role overload. The partial correlation column in Table 1 further shows that the link between temperature and role overload, with power distance controlled, is still significant ($r = .39$, $n = 20$, $p < .05$). In contrast, the partial correlation between power distance and role overload with temperature controlled lacks significance ($r = .00$, n.s.). Indeed, when power distance is controlled for, temperature still predicts 15 percent of the variance in role overload, a finding that supports Hypothesis 2. Conversely, when temperature is controlled, power distance cannot predict additional variance, which does not support Hypothesis 3. Moreover, a regression analysis showed that temperature ($\beta = .60$, $\Delta R^2 = .36$, $p < .05$) and power distance ($\beta = -.08$, $\Delta R^2 = .00$, n.s.) do not have an interactive effect on role overload ($\beta = -.39$, $\Delta R^2 = .00$, n.s.).

Explorative Analyses

The results so far suggest that the relation between power distance and role overload, rather than the relation between temperature and role overload, is spurious. Taking the role of devil's advocate, we therefore tried to demonstrate the spurious nature of the temperature-overload association. Table 1 provides estimates of the associations between each of the selected predictors on the one hand, and temperature and role overload on the other; the fourth column shows that some ($n = 13$) of the alternative predictors were whereas others ($n = 41$) were not related to the initial predictor of power distance. Although, in fact, we consider simple correspondences between only one predictor and the dependent variables inadequate, the small number of countries in each combination of samples forced us to examine the relations one by one.

TABLE 1
Cross-National Covariates of Power Distance, Ambient Temperature, and Role Overload

					Role Overload		
Predictor	Data Source	Number of Countries	*r* Power Distance	*r* Ambient Temperature	Zero-Order *r*	Partial *r* with Predictor, Controlling for Temperature	Partial *r* with Temperature, Controlling for Predictor
Ambient temperature	Garver et al. (1990)	21	.78***		.56**		.39*[c]
Power distance	Hofstede (1991)	20[b]		.78***	.44*	.00	
Role overload	Peterson et al. (1995)	21	.44*	.56**			
Economic indicators							
1. Per capita income, 1988[a]	World Bank (1992)	21	−.72***	−.75***	−.32	.17	.51**
2. Economic growth, 1973–84	World Bank (1986)	17	.77***	.55**	.39	.12	.45*
3. Unemployment rate, 1988	Year Book of Labour Statistics (1993)	15	−.29	−.31	−.01	.21	.59**
4. Income inequality	Moaddel (1994)	20	.57**	.66**	.31	−.10	.50*
5. Class exploitation	Boswell & Dixon (1993)	16	.49*	.39	.12	−.13	.56*
6. Percent engaged in agriculture	Year Book of Labour Statistics (1993)	19	.62***	.63***	.29	−.10	.51*
7. Percent engaged in trade	Year Book of Labour Statistics (1993)	19	−.02	−.05	.13	.19	.57**
8. Percent engaged in services	Year Book of Labour Statistics (1993)	19	−.68***	−.61***	−.60***	−.39*	.31
Cultural indicators							
9. Conservatism	Schwartz (1994)[d]	13	.30	.67**	.34	−.20	.64**
10. Hierarchy	Schwartz (1994)	13	.36	.65**	.41	−.05	.59*
11. Mastery	Schwartz (1994)	13	.31	.43	.08	−.32	.71**
12. Affective autonomy	Schwartz (1994)	13	−.31	−.59*	−.36	.06	.62*

TABLE 1 (continued)

Predictor	Data Source	Number of Countries	r Power Distance	r Ambient Temperature	Role Overload		
					Zero-Order r	Partial r with Predictor, Controlling for Temperature	Partial r with Temperature, Controlling for Predictor
13. Intellectual autonomy	Schwartz (1994)	13	−.28	−.70**	−.46	.03	.56*
14. Egalitarian commitment	Schwartz (1994)	13	−.24	−.56*	−.18	.32	.71**
15. Harmony	Schwartz (1994)	13	−.07	−.48*	−.65**	−.51*	.55*
Organizational characteristics							
16. Strikes, 1988–92	Year Book of Labour Statistics (1993)	16	−.36	−.44*	−.10	.20	.58**
17. Horizontal differentiation	Wong & Birnbaum-More (1994)[e]	10	−.73**	−.65*	−.53	−.27	.33
18. Vertical differentiation	Wong & Birnbaum-More (1994)	10	.29	.60*	.62*	.43	.30
19. Complexity	Wong & Birnbaum-More (1994)	10	−.38	−.16	−.05	.05	.56
20. Centralization	Wong & Birnbaum-More (1994)	10	.79***	.94***	.87***	[g]	[g]
21. Formalization	Wong & Birnbaum-More (1994)	10	−.56*	−.38	−.48	−.35	.46
22. Work accidents, 1988–92	Year Book of Labour Statistics (1993)	17	−.16	−.33	.01	.24	.59**
23. Work organization	ISR (1995)[f]	17	.15	.20	−.25	−.44*	.64**
24. Operating efficiency	ISR (1995)	17	−.14	−.05	−.19	−.20	.56**
25. Quality	ISR (1995)	17	−.00	.08	−.16	−.25	.58**
26. Company management	ISR (1995)	17	.39	.40	−.01	−.31	.61**
27. Immediate supervision	ISR (1995)	17	−.01	.09	−.26	−.38	.61**

TABLE 1 (continued)

					Role Overload		
Predictor	Data Source	Number of Countries	r Power Distance	r Ambient Temperature	Zero-Order r	Partial r with Predictor, Controlling for Temperature	Partial r with Temperature, Controlling for Predictor
28. Working relationships	ISR (1995)	17	.16	.30	−.03	−.25	.60**
29. Communications	ISR (1995)	17	.01	.01	−.41	−.50*	.62**
30. Training and information	ISR (1995)	17	.18	.33	−.08	−.35	.63**
31. Performance and development	ISR (1995)	17	.21	.32	−.02	−.25	.60**
32. Pay	ISR (1995)	17	−.17	−.00	−.20	−.24	.57**
33. Benefits	ISR (1995)	17	−.06	−.01	−.23	−.27	.57**
34. Safety and working conditions	ISR (1995)	17	−.01	.28	−.02	−.23	.59**
35. Employment security	ISR (1995)	17	.16	.51*	.12	−.24	.59**
36. Job satisfaction	ISR (1995)	17	−.23	−.27	−.58**	−.54*	.51*
37. Company identification	ISR (1995)	17	−.01	.04	−.31	−.41	.60**
Occupational preferences							
38. Country landowner and farmer[h]	Lynn (1991)[i]	15	.02	.29	−.30	−.58*	.70***
39. Small business	Lynn (1991)	15	−.23	−.03	−.10	−.09	.56*
40. Company director	Lynn (1991)	15	.34	.51*	.41	.17	.45
41. Social worker	Lynn (1991)	15	.10	.34	.27	.11	.52*
42. Doctor	Lynn (1991)	15	.34	.26	−.10	−.30	.61**
43. Teacher	Lynn (1991)	15	.06	.09	−.08	−.16	.57*

TABLE 1 (continued)

Predictor	Data Source	Number of Countries	*r* Power Distance	*r* Ambient Temperature	Role Overload		
					Zero-Order *r*	Partial *r* with Predictor, Controlling for Temperature	Partial *r* with Temperature, Controlling for Predictor
Personal characteristics							
44. Extraversion	Lynn & Martin (1995)	19	.30	.47*	.22	−.16	.68***
45. Neuroticism	Lynn & Martin (1995)	19	−.15	−.18	−.28	−.22	.67***
46. Psychoticism	Lynn & Martin (1995)	19	.11	.30	.17	−.05	.68***
47. Achievement motivation	Lynn (1991)	15	−.40	−.39	.01	.30	.61**
48. Achievement via conformity	Lynn (1991)	15	.34	.32	−.01	−.24	.59**
49. Competitiveness	Lynn (1991)	15	.47*	.47*	.34	.11	.48*
50. Mastery	Lynn (1991)	15	−.35	−.30	.15	.40	.64**
51. Work ethic	Lynn (1991)	15	.21	.13	−.10	−.21	.58*
52. Valuation of money	Lynn (1991)	15	.59**	.54*	.35	.07	.47*
53. Attitudes to saving	Lynn (1991)	15	.48*	.60**	.21	−.18	.55*
54. Subjective well-being	Diener et al. (1995)	17	−.62**	−.37	−.48*	−.32	.68**

[a] Income was based on gross national product.

[b] Missing value for Uganda.

[c] Controlling for power distance.

[d] Schwartz (1994) reported the mean importance of seven culture-level value dimensions, corrected for differences in scale use, in teacher samples from 32 countries. The following dimensions were designed and discussed in detail. *Conservatism:* maintenance of the status quo, propriety, and avoidance of actions that might disturb the traditional order. *Hierarchy:* emphasis on the legitimacy of hierarchical role and resource allocation. *Mastery:* active efforts to modify one's surroundings through self-assertion. *Affective autonomy:* pursuing one's individual interests and desires in the domain of stimulation and hedonism. *Intellectual autonomy:* pursuing one's individual interests and desires in the domain of self-direction. *Egalitarian commitment:* voluntary promotion of the welfare of other people (e.g., social justice; responsible, loyal). *Harmony:* self-transcendence into a world at peace and unity with nature.

[e] On the basis of Hofstede's dimensions of power distance and uncertainty avoidance, Wong and Birnbaum-More (1994) selected 39 banks out of the 106 multinational commercial banks operating in Hong Kong. They then compared the organizational structures of these banks, which represented 14 different home countries. Using the Aston instruments, organizational structure was measured in terms of horizontal differentiation, vertical differentiation, complexity, centralization, and formalization.

[f] ISR (1995), an International Survey Research organization, used a standard set of questionnaire items to study nationally representative samples of the employed population in more than 60 countries. National norms currently exist for 33 countries, in the form of percentages of favorable responses to the following 15 work variables. *Work organization,* e.g., "The work in my department is well organized." *Operating efficiency,* e.g., "In my judgment, my department operates efficiently." *Quality,* e.g., "My company's commitment to quality is apparent in what we do on a day-to-day basis." *Company management,* e.g., "Management provides a clear sense of direction for my company." *Immediate supervision,* e.g., "I have confidence in the decisions made by my immediate boss." *Working relationships,* e.g., "There is usually good cooperation between employees in my department and other departments." *Communications,* e.g., "My company does an excellent job of keeping us informed about matters affecting us." *Training and information,* e.g., "In my opinion, employees new to my company receive adequate training for their jobs." *Performance and development,* e.g., "I understand how my job performance is evaluated." *Pay,* e.g., "Compared with other people working for my company, I think I am paid fairly." *Benefits,* e.g., "My company's fringe benefits fit my needs." *Safety and working conditions,* e.g., "Overall, the physical working conditions where I work are satisfactory (e.g., ventilation, temperature, space to work, etc.)." *Employment security,* e.g., "I can be sure of a job with my company as long as I perform well." *Job satisfaction,* e.g., "Morale where I work is generally high." *Company identification,* e.g., "I would recommend my company as a good place to work."

[g] Cannot be computed.

[h] The means and standard deviations of the countries listed in the lower half of Lynn's (1991) Table 23 (i.e., Israel to Yugoslavia) correspond perfectly with those appearing in Lynn's preceding table (Table 22). Hence, we assumed a printing error and calculated the correct mean scores from the breakdown for men and women in each country.

[i] Lynn (1991) employed collegiate samples, consisting of 50 percent male and 50 percent female students, drawn from all faculties of universities in 41 countries to assess individual-level attitudes and personality traits. The means for men and women were weighted equally. *Occupational preferences* for the jobs of landowner and farmer, small business owner, company director, social worker, doctor, and teacher, were measured through the question, "How much would you like to do each of these jobs?" The Ray-Lynn *achievement motivation* scale and Gough's *achievement via conformity* scale provided measures of the need for excellence and the identification with the organization and its success, respectively. Spence and Helmreich's questionnaire was used to assess *competitiveness* (the motive to be better than others), *mastery* (the need for control of problems and events), and *work ethic* (the moral commitment to work. *Valuation of money* and *attitudes to saving* were respectively measured by scales originally constructed by Furnham and by Yamauchi and Templer.

* $p < .05$
** $p < .01$
*** $p < .001$

For 50 of the 54 alternative predictors (binomial test: $Z = 6.12$, $p < .001$), the relation between temperature and role overload controlled for the predictor ($|\bar{x}_r| = .57$, s.d. = .09) appears to be stronger than the relation between the predictor and role overload controlled for temperature ($|\bar{x}_r| = .24$, s.d. = .13, $Z = 2.90$, $p < .01$). Moreover, the partial temperature-overload correlation reaches significance 47 times ($Z = 5.31$, $p < .001$), whereas the partial predictor-overload correlation reaches significance only 6 times ($Z = -5.58$, $p < .001$). The percentage of the workforce engaged in service areas and job satisfaction are the only variables that have significant partial correlations with role overload that are stronger than its correlation with temperature. However, we do not view these variables as viable alternatives to the predictive power of temperature, for reasons of chance capitalization ($p = .04$, n.s.) and negligibility of the differences (percentage engaged in services, $r = -.39$ versus $r = .31$; job satisfaction, $r = -.54$ versus $r = .51$). In conclusion, the relations between the alternative predictors and role overload rather than the relations between temperature and role overload are spurious.

DISCUSSION

The contribution of the current research about the cross-national origins of role overload is threefold. First of all, the study emphasizes and shows that the assessment of single and simple cross-national differences in organizational environment, internal structure or process, and work manifestations, as well as differences in their interrelations, is of little value. A research effort's value increases when it is strongly theory-driven, but even then alternative explanations may put a spoke in the researcher's wheels (cf. Berry et al., 1992; Lytle et al., 1995). Of course, authors and reviewers should always keep a careful watch on the development and subsequent refutation of rival arguments and predictions, but this warning preeminently applies to "cross-research" in which entire nations or cultures are compared.

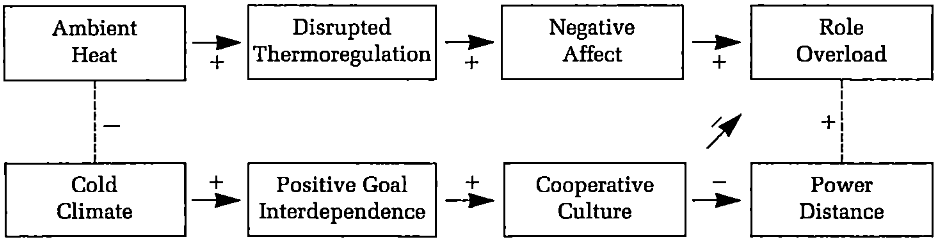
Second, the study inevitably directs attention to atmospheric macrolevel determinants of organizational behavior. Indeed, the antecedent condition of ambient temperature highlighted here represents a category of distal contextual factors, including barometric pressure (Mills, 1942), precipitation and humidity level (Poulton, 1978), and air pollution (Rotton & Frey, 1985), that might not leave individual workers unaffected (for a critique of lunar cycle research, see Campbell [1982]). For example, scholars in adjacent disciplines (Aschoff, 1981; Myers & Davies, 1978) have demonstrated the importance of the duration of sunshine and ultraviolet radiation for seasonal rhythms in human behavior. To date, virtually no handbook or journal in the field of organizational theory and practice has addressed these and similar influences of the outer physical environment on workers' perceptions, motivation, well-being, and performance. Recent reviews (Cappelli & Sherer, 1991; Mayo, Pastor, & Wapner, 1995; Mowday & Sutton, 1993) make it painstakingly clear that this kind of contextual explanation has not yet been incorporated into the paradigm of organizational behavior research. The fact that Peterson and colleagues (1995) overlooked the potential role of ambient temperature when explaining cross-national differences in role stresses reflects where the herd is going rather than a few people's straying away from the herd.

Third, the study makes a strong case for the conclusion that ambient temperature predicts role overload over and above the cultural dimension of power distance and other macro-, meso-, and microlevel characteristics, but not vice versa. The hidden existence of countless alternative explanations prevents us from concluding that ambient temperature is a sure origin, let alone *the* origin, of role overload. Also, the proportion of variance attributable to ambient temperature was small. There are certainly other variables that might predict as much, or even more, variance in role overload, although we have not yet been able to locate them.

The pronounced relationship between ambient temperature and role overload is remarkable because the hypothesized differences were put to a conservative test in several respects. First, really hot countries such as Sudan, Niger, Chad, Mali, and Upper Volta ($\bar{x} = 36$°C) were not included in Peterson and colleagues' (1995) sample. Second, the role overload data were obtained from middle managers, who often work in climate-controlled settings and not outdoors. Third, the temperature-overload relation was controlled for a variety of third factors, one at a time. Indeed, the restricted range of ambient temperatures, the likely presence of air conditioning, and the elimination of common variance with alternative predictors may well have led to an underestimation of the true temperature-overload relationship. Against this background, we have to nominate ambient temperature as a serious candidate for a position among the antecedent conditions of role overload at work.

Educated speculation based on the above considerations and the results reported in Table 1 suggests a physiopsychological and an evolutionary cultural explanation of the mysterious but unmistakable heat-overload link. The first explanation, based upon the current body of research in physiological and work psychology, is a rudimentary *theory of heat-affect-overload* consisting of three propositions. Figure 1 provides a visual representation of these propositions, which are as follows: *Proposition 1:* Heat disrupts the thermoregulatory system of the human body (Hancock, 1982; Poulton, 1978;

FIGURE 1
Rival Theories of Heat-Affect-Overload and Climate-Culture-Overload



Thompson, 1988; Zajonc, 1994).[3] *Proposition 2:* Disruption of the thermoregulatory system produces negative affect (Anderson, Deuser, & DeNeve, 1995; Baron & Bell, 1976; Bell & Baron, 1976; Tedeschi & Felson, 1994; Zajonc, 1994). Inhabitants of nations with hotter climates (higher mean daytime temperatures) do indeed report lower levels of subjective well-being ($r = -.47$, $n = 55$, $p < .001$ [Diener & Diener, 1994]). *Proposition 3:* Negative affect elicits experiences of role overload (cf. Brief et al., 1988; Burke et al., 1993; Watson et al., 1988). The results shown for subjective well-being in Table 1 support this link between negative affect and role overload: nations with unhappier populations do suffer more from role overload. Evidently, this speculative and simple set of four subsequent variables requires systematic investigations that address the complete chain of causes and effects.

If the heat-affect-overload theory holds true, researchers should compare measures of role overload from different countries, organizations, or organizational departments only after controlling them for ambient temperature. Further, it can be argued that role overload scores should be controlled for the body temperature of respondents, which is dependent on both the heat gained from or lost to the external environment and the heat gained through metabolic processes (Thompson, 1988; Zajonc, 1994). How many calories in excess heat the living cells of the body produce depends on daily diet, the heaviness of the work performed, working time arrangements, and the like (Poulton, 1978; Thierry & Meijman, 1994; Thompson, 1988; Van Dormolen et al., 1988). As a consequence, more role overload will be experienced not only by workers in hotter work environments, but also by workers who eat more, who perform heavier work, who do shift work, and so forth. These proposed interactive effects of ambient heat, daily diet, and work conditions on the experience of role overload are promising avenues for further research.

The second speculative explanation of the observed heat-overload link departs from Peterson and colleagues' (1995) finding of the link between the cultural degree of power distance and the degree of personally experienced role overload. From the evolutionary paternal investment theory (e.g., Clutton-Brock, 1991; Miller, 1994; Van de Vliert et al., 1995) it borrows the axiom that climate shapes culture, which in its turn shapes human behavior. The result is a *theory of climate-culture-overload,* which is as rudimentary as the theory of heat-affect-overload, and which will also be presented in the form of three propositions (see Figure 1).

Proposition 4: Societies living in cold climates with a prolonged winter evolved positive goal interdependence (Hofstede, 1980, 1991; Lee, 1968; Miller, 1994). In cold climates, meeting basic needs for food, safety, and security is much more demanding than it is in warm climates, so a more positive relation exists between the attainment of one's own and others' goals (cf. Moran, 1979). That is, to a greater extent men, women, and their offspring stand or fall together. As a consequence, over many generations, people evolved more shared responsibilities and more need for technology as a condition for joint survival. Notably, survival requires more large game hunting by groups that share their skills. Additionally, survival requires less fallible and vulnerable instruments.

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[3] Atmospheric heat can have its disruptive impact only if employees are working outside climate-controlled settings, which restricts the generalizability of the heat-affect-overload theory.

Proposition 5: Positive goal interdependence produces a culture of cooperative attitudes and behaviors. Indeed, considerable research has shown that group members under circumstances of greater positive goal interdependence manifest more integrative intentions and actions. They are more open minded regarding others' arguments and desires, more concerned about others' outcomes, and more inclined to search for solutions and compromises, simply because self-interest requires problem solving and negotiation (Deutsch, 1949, 1973; Janssen, 1994; Johnson & Johnson, 1989; Pruitt & Carnevale, 1993; Tjosvold, 1991; Tjosvold & Deemer, 1980; Van de Vliert, in press). Support for the link between cold climate and cooperative culture comes from our findings for competitiveness (Table 1); inhabitants of cooler countries are less competitive ($r = -.47$; $n = 15$, $p < .05$) and their culture is characterized more by egalitarian commitment ($r = .56$, $n = 13$, $p < .05$) and harmony ($r = .48$, $n = 13$, $p < .05$).

Proposition 6: A cooperative culture counteracts experiences of role overload. Deutsch (1949), followed by Johnson and Johnson (1989) and Tjosvold (1991), pointed out that cooperative situations are characterized by individuals' willingness to allow someone else's actions to replace their own, which encourages division of labor, role specialization, and delegation of work. Other features of a cooperative culture are positive attitudes toward others and a readiness to extend social support. Given the well-documented role of social support in stressful work situations (e.g., Beehr & McGrath, 1992; Buunk, 1990; Buunk, Jans, Doosje, & Hopstaken, 1993; Buunk, Janssen & Van Yperen, 1989; Cooper & Payne, 1978; Dompierre et al., 1993; Kahn et al., 1964; Peeters, 1994; Sarason, Sarason, & Pierce, 1990), we assumed that both behavioral tendencies reduce the experience of role overload. Again, some support for the link between cooperative culture and role overload comes from our findings on competitiveness: inhabitants of less competitive countries tend to experience less role overload ($r = .34$, $n = 15$, $p < .05$, one-tailed test).

Compared to the theory of heat-affect-overload, the theory of climate-culture-overload better explains Peterson and colleagues' positive correlation between power distance and role overload (see Figure 1). Overall, the assumption that middle managers inhale outside air because they are working out in the elements is not credible. It is more plausible that a climate-based cooperative culture tends to reduce experiences of both role overload and power distance. That is, most likely the cooperativeness found in cold climates will foster relatively small power distances. Indeed, organizations in cooler countries, having less competitive employees, are less centralized and are differentiated horizontally rather than vertically (see variables 17, 18, and 20 in Table 1). Not surprisingly, they are embedded in national cultures characterized by less conservatism and hierarchy and more autonomy, egalitarian commitment, and harmony (see variables 9 through 15). Taken together, and given the temperature-overload link, these findings may indicate that the positive correlation between power distance and role overload is a spurious one.

The main limitation of the present study is its small sample of 21 countries. Hence, statistical techniques more advanced than first-order partial correlation could not be used. Furthermore, the cooler countries studied are largely European. This geographic proximity, in combination with the fact that much of the world industrialization has its roots in European expansion, may well have led to a spurious correlation between temperature and role overload. Much larger samples of countries representing the whole globe are urgently needed to move the development of cross-national organization theories toward greater generalizability, accurateness, and complexity.

Table 1 can be used as a source of inspiration for future research and theory building on organizational phenomena from a cross-national viewpoint. The available data suggest that inhabitants of hotter countries, including Brazil, Nigeria, Indonesia, Singapore, and India, experience both larger power distances and more role overload than the inhabitants of cooler countries. The data further show that workers in hotter countries are engaged more in agricultural and less in service areas and enjoy more job security; they work in organizations that are more centralized and differentiated vertically rather than horizontally; they earn less, face more income inequality, and value both money and money saving more. At the same time, these workers in hotter countries are more extraverted and competitive, show a stronger preference for the job of company director, strike less, and realize a higher economic growth rate. This pattern of results is in line with some central parts of Mintzberg's (1979) typology of structural configurations, especially where centralized "simple structures" are contrasted with decentralized "divisionalized forms." In combination with the per capita income, economic growth, and employment security figures, the findings suggest the hypothesis that back in the 1980s simple structures were more often found in hotter and poorer but rapidly developing countries (e.g., Nigeria, India, and Indonesia), whereas divisionalized forms were more often found in colder and richer countries coping with economic stagnation (e.g., the United Kingdom, France, and Germany).

In addition, several of the correlation coefficients reported here elicit questions with regard to organizational phenomena at several levels. At the national level, one question is, Why do hotter countries have lower levels of productivity? ($r = -.75$); at the organizational level, this question emerges: Does greater competitiveness lead to a more hierarchial structure or the other way around? ($r = .47$); and at the group and individual level, Are good communications (zero-order $r = .01$ vs. partial $r = .62$) and the work ethic (zero-order $r = .13$ vs. partial $r = .58$) really suppressors of the temperature-overload relation? Overall, this investigation, inspired by an illustrative question—Does ambient heat overload workers?—ends with a more specific question: Why is heat of such great weight?

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FROM CHIMNEYS TO CROSS-FUNCTIONAL TEAMS: DEVELOPING AND VALIDATING A DIAGNOSTIC MODEL

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This article develops a framework for studying cross-functional teams in organizations that focuses on three domains: organizational context, internal process, and outcome measures. The framework was developed from qualitative data from over 200 individual and group interviews, written descriptions, and team observations. We then operationally defined this model through a set of questionnaire items and validated it through quantitative analysis of data from 565 members of cross-functional teams. The resulting framework provides a base for the future study of cross-functional teams.

Cross-functional teams (CFTs) are spreading rapidly in organizations as they attempt to improve coordination and integration (Ford & Randolph, 1992; Knight, 1976), span organizational boundaries (Ancona, 1990; Ohmae, 1990), and cut cycle time in new product development (Ancona & Caldwell, 1992a; Hitt, Hoskisson, & Nixon, 1993; Takeuchi & Nonaka, 1986). Cross-functional teams take many forms, but they are most often structured as working groups, created to make decisions lower in an organization's hierarchy, that have links to multiple subunits—or "chimneys"—and are designed as an overlay to an existing functional organization (Galbraith, 1994). CFTs share many characteristics with conventional teams, but they also differ in important ways: First, they are usually representative groups in which each member has a competing social identity and obligation to another subunit of the organization (Alderfer, 1987; Alderfer & Smith, 1982; Brown, 1983). Second, they are often temporary task teams experiencing abundant pressure and conflict, so the early development of stable and effective group processes

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is critical to their success (Ford & Randolph, 1992; Gersick & Hackman, 1990). Third, cross-functional teams typically confront a different set of performance expectations than conventional work teams and are often expected to reduce cycle time, create knowledge, and disseminate organizational learning (Nonaka, 1991; Pinto & Slevin, 1988a, 1988b).

Empirical research on cross-functional teams, however, has lagged well behind their rate of adoption (Knight, 1976). Existing research on teams and their organizational contexts provides a useful point of departure but has left many important questions unanswered (Ancona, 1990; Ancona & Caldwell, 1992a; Gladstein, 1984; Hackman, 1987, 1990). In this article, we sought to develop a framework and a set of measures for examining cross-functional teams by first collecting and analyzing qualitative data from 200 members of CFTs to develop a conceptual framework and an item pool. We then refined those measures through the analysis of survey data from three separate samples totaling 565 team members. Thus, the primary contribution of this research is to examine a new and emerging organizational form and to develop a framework and a set of measures that can be used in studying that form. In addition, this article makes a contribution by contrasting CFTs with other types of teams and linking this research with the existing literature on teams and their contexts.

CROSS-FUNCTIONAL TEAMS: BUILDING ON THE LITERATURE

Although there is little existing literature directly on cross-functional teams, two related streams of research have served as a starting point: The first of these is the literature on teams and their organizational contexts (Ancona, 1990; Ancona & Caldwell, 1992b; Gladstein, 1984; Hackman, 1987, 1990), and the second is the work on product development teams, which has frequently addressed the process of combining varied sources of expertise to create innovative outcomes (Cohen & Ledford, 1991; Donnellon, 1995; Katz, 1982; Katz & Allen, 1985; Pelz & Andrews, 1976; Takeuchi & Nonaka, 1986).

The Organizational Context of Teamwork

Many authors have addressed the topic of team-based organizational design (Galbraith, 1973; Hackman & Walton, 1986; Leavitt, 1975; Manz, 1992; Pasmore, 1988), but relatively few have discussed the organizational context of teams—the overarching structures and systems external to a team that facilitate or inhibit its work. We begin by reviewing two distinct approaches to organizational context that appear in the literature, the first focusing on an organization's impact on teams (Hackman, 1987, 1990) and the second examining the teams' attempts to influence the larger organization (Ancona, 1990; Ancona & Caldwell, 1992a, 1992b).

These two approaches share several characteristics. For example, both perspectives examine context by looking at the interactions that occur in the interface between individual teams and their organizational environment. As such, they share a definition of context as something external to the team yet internal to the organization. In both approaches, team effectiveness is also a concern and is addressed through three-stage *context-process-outcome* models. These models are linked to more traditional social psychological input-process-outcome models (Hackman & Morris, 1975; Sundstrom, DeMeuse, & Futrell, 1990) and incorporate many of the suggestions offered by Guzzo and Shea (1993), Mowday and Sutton (1993), and O'Reilly (1991) in their discussions of the importance of developing a contextual perspective in group and organizational research.

Hackman's (1987, 1990) model of team effectiveness conceptualizes the impact of organizational context on teams in terms of three main influences: (1) the design of a team and its task, (2) the transfer of information, resources, and rewards to the team, and (3) the existence of process assistance that can be provided to facilitate a team's work. These three factors define the context domain and incorporate it within a general model of the effectiveness of work teams that also includes team processes and task outcomes. Our research was also influenced by Hackman's discussion of the relationship between context, team processes, and outcomes as well as by Gladstein's (1984) study showing that contextual factors were more potent determinants of team effectiveness than internal team processes.

The second approach to studying teams and their organizational contexts focuses on how teams manage their interface with the larger organization (Tushman, 1977; Tushman & Katz, 1980). Ancona and Caldwell (1988), for example, examined how project teams managed their organizational contexts in high-technology companies. Ancona (1990) extended this research by describing the role orientations of effective and ineffective consulting teams in an educational organization. Teams that were isolated, passive, or overly technical were far less successful than teams that proactively managed the political dynamics of their client organization. Ancona and Caldwell (1992b) reported similar findings from a study of product development teams.

Both of these perspectives have been applied to a wide range of teams, and they help to explain many aspects of the functioning of cross-functional teams. But several aspects of the multifaceted context of such representative teams are not addressed, since the primary purpose of these models is to conceptualize a team's interaction with a primary context. Hackman's model, for example, conceptualizes context in terms of the transfer of information, resources, and rewards from organization to team and pays only limited attention to possible conflicts and inconsistencies among the sources of these inputs. In addition, little empirical research has been done on the factors outlined in Hackman's (1987, 1990) model of team effectiveness.

Ancona (1990) and Ancona and Caldwell (1988, 1992a, 1992b) also presented a model that tends to conceptualize the influence of a team on a relatively unitary (albeit complex) organizational context. They argued that team members manage context through their strategic role orientations—teams with "task coordinators" or "ambassadors," for example, will be better able to control their context than teams whose members play the more passive role of "scout." These authors paid less attention, however, to the targets of a team's scouting or diplomacy, or to the need to scout one context, coordinate with a second context, and be diplomatic toward a third. CFTs must, however, coordinate action among a diverse set of functions, interests, and areas of expertise in order to be successful (Donnellon, 1995; Manz & Sims, 1987).

The existing literature on teams provides a rich base for conceptualizing the internal process of cross-functional teams, but neither Hackman nor Ancona included a particularly rich set of process dimensions in their studies of context, process, and outcomes. Since the fragmented context in which these teams operate may in fact place significant strains on team processes, it seems important for new research to reexamine the role of such processes in conjunction with a study of a multifaceted context. Finally, the relevant range of outcomes for CFTs has received little attention in existing research on context. Although such teams' tasks are integrative and often creative, existing studies of context have typically examined conventional outcomes, such as task performance, cohesiveness, and member satisfaction. Concern with these outcome issues, in particular, led us to examine additional research literature on product development teams.

Product Development Teams: Internal Processes and Outcomes

As noted in the introduction to this article, there are many different varieties of CFTs, including planning teams, ad hoc project teams, quality teams, process improvement teams, and product development teams. Although there are important differences among these types of teams, they all are typically task teams, with members representing multiple organizational functions, that are formed to integrate expertise from those functions and operate at a lower level in the hierarchy.

One research literature that helps contribute to a general understanding of CFTs is that on product development teams, a specific type of cross-functional team. Product development teams focus on combining diverse sources of expertise in order to develop innovative new products. Although some product development is still done by functional (for instance, engineering) teams, this approach is increasingly rare. Research on product development teams in many cases helps to highlight the general problems facing CFTs of all types.

Research on project management, new product development, and organizing for innovation and creativity (Imai, Nonaka, & Takeuchi, 1985; Larson & Gobeli, 1988; Pelz & Andrews, 1976; Tushman, 1978; Tushman & Nadler, 1986) has shown that effective new product development occurs when two conditions are present: First, the requisite diversity of viewpoints, disciplines, and functional specialties is represented in a team, and second, the team is able to span organizational boundaries and integrate the functional expertise represented by team members (Fruin, 1996).

This literature addresses the issue of the relationship between CFTs and their contexts but does so primarily in terms of the conflict created by matrix structures (Davis & Lawrence, 1977; Galbraith, 1973, 1994; Larson & Gobeli, 1987). Most product development teams are influenced by one line of authority for the functions—the source of the specific forms of expertise required to develop a new product—and a second line of authority for the project organization developing the product (Gobeli & Larson, 1987).

Implicit in this literature is the notion that cross-functional teams can perform systemic tasks such as product development better than functions working in isolation (Ancona & Caldwell, 1992a; Clark & Fujimoto, 1991; Nonaka, 1990; Takeuchi & Nonaka, 1986). This idea, however, often neglects the fact that team membership, identity, and loyalty in CFTs may be in question (Donnellon, 1995). Donnellon argued that CFTs are less often teams with a high degree of interdependence, a group task, and a strong group identity than they are "co-acting" work groups composed of independent, highly competitive individuals who pursue their own goals over those of the teams (Hackman, 1987; Katzenbach & Smith, 1993). These issues seem to suggest that internal team processes are an important mechanism to create organizational coordination (Ancona & Caldwell, 1987, 1990; Barker, Tjosvold, & Andrew, 1988).

The literature on product development teams also suggests a more relevant and complete set of outcome measures than traditional research on groups and their contexts (Gobeli & Larson, 1987; Pinto & Slevin, 1988a, 1988b). This research adds to the traditional measures of task accomplishment, cohesion, and member satisfaction, concerns such as time compression, innovation, the integration of diverse viewpoints, learning, and capability development (Clark & Fujimoto, 1991; Takeuchi & Nonaka, 1986).

Although the team context and product development literatures have generated important insights concerning the contexts, processes, and outcomes of effective teams, they have produced less in the way of theory development, comparative research, and development of measures. Thus, our central concern, the development of a framework for understanding the effectiveness of cross-functional teams and a complementary set of valid measures, has received only limited attention in either literature.

METHODS

This study was conducted in two separate stages: First, we gathered qualitative data from stories, interviews, written descriptions, and observations. A content analysis of these data suggested a set of issues that cross-functional team members thought were important to the effectiveness of their teams. Next, we used these issues and the qualitative data from which they were drawn as a basis for generating a pool of questionnaire items that began to operationally define influences on team effectiveness (Pinto & Prescott, 1988). Drawing on previous research that has defined context, process, and outcomes as important domains in team research (Ancona, 1990; Ancona & Caldwell, 1992b; Gladstein, 1984; Hackman, 1987, 1990), we grouped the issues and items into three domains and began to identify the most salient items and dimensions for each domain. Analysis of data from two samples of members from a diverse collection of CFTs was used to refine a set of measures for the dimensions within each domain. All data were collected from multiple divisions and locations of one multinational organization, a large American automobile manufacturer, and included data from team members in 15 different countries. This article reports the results in detail for the final sample of 364 members of 43 product development teams.

We began collecting data by conducting 50 informal interviews with members of CFTs, including planning teams, quality teams, process improvement teams, and product development teams. Each interview focused on the effectiveness of a team that the interviewee had been a member of, and the data were captured as a set of stories about the important characteristics of CFTs. Next, we collected written descriptions of teams from 174 middle managers who had been members of CFTs and were participants in a management development program. They were asked to describe, in writing, an effective cross-functional team and an ineffective cross-functional team and to list the characteristics that they thought distinguished effective and ineffective teams.

Data from both of these sources were content-analyzed and then summarized in terms of a set of concepts and themes that captured the range of issues represented in the qualitative data. We grouped these concepts and themes into the three domains of context, process, and outcomes as suggested by the literature. From this set of concepts and the coded qualitative data from which they were drawn, we then developed an initial pool of questionnaire items to be used as the basis for a set of measures.

The second stage of the research focused on refining a valid and reliable set of measures for the context, process, and outcome domains suggested by the literature. In several cases in which the context was similar to existing scales in the literature, we borrowed items to help measure dimensions (Hackman, 1987; Hart, 1985). Next, we administered a questionnaire with this set of 123 items to 200 middle managers in a company executive development program. Respondents were asked to identify a team that they had been a member of and to respond to the items with respect to that team. On the basis of results, we added, discarded, or reworded items. This refinement process also involved frequent reference back to our qualitative data (Glaser & Strauss, 1967). This process was then repeated a second time on a second sample of 200 middle managers.

The resulting set of items was then administered to the members of 43 intact CFTs who were involved in three large product development programs, each of which was dedicated to one vehicle. Each of these programs was led by a program manager and was made up of 15–30 cross-functional teams that held responsibility for separate modules or subunits of the vehicle. Each of these teams had a core of 5–20 members who came from functional organizations such as design, body or powertrain engineering, manufacturing, marketing, purchasing, and so on. Since the official list of team members often included nominal members who did not attend meetings or contribute much, we asked the leaders of each team to identify core members of the team, those who attended meetings regularly, spent at least 20 percent of their time working for the team, and were central to the team's activities.

Using this procedure, we targeted 565 individuals who were members of 43 CFTs as questionnaire respondents. Surveys were distributed to core team members by their team leader at one of their regular meetings, and respondents were given two weeks to complete the survey and return it to us using an enclosed envelope. After three weeks, a second set of surveys was distributed to those who had not yet responded. Overall, 364 respondents representing 43 CFTs responded for an overall response rate of 65 percent. The respondents were primarily managers and engineers between the ages of 25 and 55, 85 percent of whom were men.

RESULTS

We begin by presenting a brief story for each domain, illustrating some of the dimensions identified by our qualitative research; we then present a factor analysis of the item pool for the domain. Finally, we present a second-order confirmatory factor analysis conducted to determine if the derived factors fit into the three domains suggested by the literature and by our qualitative analysis.

Organizational Context

The context of cross-functional teams is complex and differs from that of more conventional teams in that it includes hierarchical, lateral, and interteam dependencies that require continuous negotiation. For teams to exist within an organizational environment, they must define their role in relation to upper management and resolve the inherent conflicts between the functions that they represent. An example drawn from an interview in one product development team shows how difficult this can be:

> The total amount of electrical power in a vehicle is determined by the capacity of the alternator. This power must serve over 20 subsystems, such as the stereo, the engine, the instrument panel, and so on. These subsystems are developed and controlled by separate "chimney" organizations, and power allocations must be made for each system. The problem was, in this vehicle program, when the requirements of all the chimneys and teams were added up, they equaled 125 percent of the capacity of the alternator. Keith, who had recently taken over as head of this vehicle program, which had made many changes in direction and was behind schedule to begin with, called a meeting of the Program Steering Team designed to resolve this conflict and reach a compromise. However, many of the chimney representatives who were the members of the team came to this meeting with instructions from their bosses (who, incidentally, did their performance appraisals . . .) *not* to make any compromises, but to make certain that their chimney "got what it needed" and "didn't lose out." After Keith presented the group with the problem and the need to reach a compromise solution, their response surprised him: "It's not *our* problem," they replied, "it's *your* problem." Keith soon changed jobs again.

This story illustrates several of the critical dimensions of organizational context and their relation to team effectiveness. Power dynamics between teams and functional organizations can greatly limit the autonomy of a team and must be managed proactively. Furthermore, when a team's mission is a "moving target," its power is diminished. In addition, coordination with other cross-functional teams is often required. Finally, many needed resources and rewards, as this example illustrates, are controlled by the functional organizations rather than the team itself.

Table 1 presents the exploratory factor analysis (principal components with varimax rotation) for the context domain. Factor loadings above .50, our cutoff point for including an item in a factor, are presented in bold type.

The results show six dimensions with eigenvalues greater than 1.0: coordination with other teams; autonomy and power; linkage to functions; resources; mission and direction; and reward for team performance.

Team Processes

The conflicting demands inherent in the organizational context place a premium on a team's internal processes. Team members need to be both representatives of their functional authority structures and creative problem-solvers. Meeting both of these demands requires a broad and flexible team process. The following story, taken from a process improvement team, illustrates some of these dynamics:

> Our formalized approach to managing cross-functional teams can really get in the way. [For example,] . . . our organization has several common practices that make an effective team process difficult. [First,] . . . we always meet in large horseshoe shaped conference rooms and take turns making presentations to each other. Very few of these meetings actually lead to creative problem solving. Sometimes, a representative from one of the chimneys will come in and "drop the bomb," (deliver unexpected bad news) and then leave. [Second,] . . . the team is really a collection of subteams that come and go during a meeting depending on what's on the agenda. The "heavy breathers" (bosses) back home in the functions will sometimes even send a delegate to our meetings with instructions to just watch and "make sure nothing happens." The result is that the group doesn't take collective responsibility, and that can be very demotivating. [Third,] . . . many teams are assigned "content" leaders and "process" leaders. The content leader is the technical expert—the "real" boss—and the process leader helps run meetings and manage the team. The problem is that an effective team has to have flexible leadership—leadership and expertise need to change according to the issue and get passed around as needed.

This example illustrates the demands for both functional representation and creativity and the need to develop team identity and normative expectations if a team is to take collective responsibility for resolving a diverse set of demands. Leaders who facilitated flexible problem solving and team development seemed to have an advantage.

Table 2 presents the analysis for the team process domain. It reveals six factors: norms; the importance of the team's work; effort; efficiency; creative strategy; and breadth.

TABLE 1
Results of Factor Analysis of the Organizational Context Domain

Factors and Items	1	2	3	4	5	6
Coordination with other teams (α = .813)						
Our team is good at coordinating work with other teams in the program.	**.624**	.215	.215	.192	.109	.227
The team is well-informed about activities of other teams doing related work.	**.549**	.143	.143	.184	−.005	.116
Our team has difficulty working with other teams in the program.[a]	**.500**	−.410	−.191	−.183	.077	−.011
Our team is isolated from the rest of the program.[a]	**.548**	−.191	−.410	−.099	.146	−.151
Autonomy and power (α = .802)						
The team's leader is effective at "going to bat" with upper management to get what is needed for the team.	.166	**.807**	.109	.228	.014	−.012
Our team leader is a role model for the way that the job should be done in the future.	.218	**.862**	.001	.085	.037	.070
Our team leader has the "clout" necessary to make things happen.	.012	**.706**	**.077**	.172	.132	−.086
Linkage to functions (α = .685)						
Members of this team have enough authority to make important decisions for their home organization.	.243	.143	**.558**	.141	.035	.621
Our team is able to resolve problems between the different home organizations effectively.	.048	.070	**.707**	.050	.110	.035
Disputes between the different home organization represented on our team make it difficult to do our work.[a]	−.059	−.080	**.712**	−.146	−.002	−.191
Resources (α = .721)						
My home organization provides teams with the resources that they need to perform well.	.243	.159	.159	**.780**	.098	.035
My home organization's control over budgets makes it difficult for the team to do its work.[a]	.004	−.011	−.011	**.822**	−.094	−.021
Mission and direction (α = .757)						
I have a clear understanding of the program's mission.	.014	.021	.021	.090	**.535**	.035
I have a clear understanding of the team's mission.	.215	.165	.215	.105	**.719**	.056
There is a clear mission statement or charter for my team.	.037	.171	.171	.055	**.746**	−.131
The team has a clear idea what is expected from them.	.145	.219	.219	.148	**.658**	.229
Reward for team performance (α = .665)						
My performance review depends upon my performance as a member of the team.	.114	−.209	.209	.055	.154	**.786**
My performance review depends upon the performance of the team.	.086	−.115	−.115	.172	.045	**.837**
Effective work in support of teams is critical to my advancement within the organization.	.396	.229	.229	−.085	−.065	**.607**
Eigenvalues	6.751	1.940	1.503	1.313	1.171	1.04

[a] Item was reverse-coded.

TABLE 2
Results of Factor Analysis of the Team Process Domain

Factors and Items	1	2	3	4	5	6
Norms ($\alpha = .859$)						
It is clear in our team what is acceptable behavior and what is not acceptable.	**.835**	−.051	.115	.315	.315	.174
Behavior in our team is very orderly—it is clear what members are expected to do and they do it.	**.719**	−.041	.271	.367	.187	.112
Our group has clear standards for the behavior of group members.	**.833**	−.054	.142	.148	.219	.175
The team has a strong process leader.	**.695**	.447	−.015	.195	.076	−.111
Importance of the team's work ($\alpha = .808$)						
It was exciting for me to participate on this team.	.272	**.571**	.085	.071	.014	.186
I am highly challenged by working on this team.	.115	**.646**	.077	.064	.062	.264
The team's work is highly important to my own career.	.196	**.773**	−.115	−.012	.194	−.257
The team's work is highly important to the company.	−.071	**.791**	.002	.195	.176	.195
The team's work is highly important to my department.	.021	**.743**	.146	.032	.095	.064
Effort ($\alpha = .690$)						
Some individuals do not pull their share of the workload.[a]	−.051	.059	**.826**	−.187	−.313	.127
Everyone on our team cares about the team and works to make it one of the best.	.312	.076	**.802**	−.006	.164	.006
Core team members give the team's work highest priority.	.347	.015	**.340**	.039	.181	.189
Efficiency ($\alpha = .759$)						
In our team meetings we often get sidetracked into discussing peripheral issues.	−.125	−.176	−.251	**.784**	−.029	−.084
After an issue is raised, we quickly reach a decision as to what to do about it.	.115	.195	.192	**.746**	.195	.395
Team meetings are well organized and productive.	.378	.296	.215	**.534**	.061	.175
Creative strategy ($\alpha = .832$)						
Our team frequently experiments with alternative ways we might carry out our work.	.185	.194	.374	.176	**.745**	.063
Our team is highly imaginative in thinking about new or better ways we might perform our task.	.214	.115	.259	.299	**.779**	.117
When a non-routine matter comes up in our work, we often invent new ways to handle the situation.	.287	.198	.115	.176	**.725**	.094
Breadth ($\alpha = .618$)						
I feel that this team integrates diverse viewpoints.	.405	.086	.021	−.395	.258	**.590**
My perspective is well-integrated into the team's outcome.	.131	.142	.156	.084	.127	**.551**
I understand how our team's work fits into the whole product.	.059	.415	−.115	.336	.046	**.503**
Eigenvalues	8.870	2.470	1.590	1.347	1.117	1.068

[a] Item was reverse-coded.

Outcomes

The criteria of effectiveness for cross-functional teams are many and varied. As the example below illustrates, success can often require that *all* criteria be met, since failure on any criterion may mean failure for the entire project.

> For one "high profile" new product, a program manager and core team were selected and given the responsibility for hitting specific "targets" for cost, weight, and timing. Since program management represented a new way of working, the team members necessarily "invented it as they went along," to a great extent. The excitement surrounding this new effort generated a great deal of learning and innovation, both about the product and how to work in a cross-functional environment. The team members greatly expanded their abilities and understandings over the course of the program. Despite several false starts and blind alleys, the product ultimately won "Car of the Year" honors upon its introduction. However, because the program missed the cost and weight targets established by upper management, the program managers never survived to apply their skills to a second program.

This story points to the wide range of outcomes expected from cross-functional teams: Not only are they expected to produce innovation, learning, and new capabilities, but they are also called upon to compress time and hit stringent task targets. Member satisfaction is also a key outcome if the team approach is to remain a viable way to organize future product development efforts.

Table 3 presents the analysis for the outcome domain. It reveals seven factors: information creation, time compression, image expansion, learning, growth satisfaction, overall effectiveness, and capability development.

Table 3 also shows that information creation and time compression items loaded on the same factor, as did learning and growth satisfaction items. A more detailed analysis of each of these sets of items showed that they separated into two factors when analyzed alone. Since some potentially important theoretical issues distinguish these constructs, they are reported separately in Table 3.

Figure 1 presents the three-domain model and the factors included in each domain. We examined the validity of these three domains by performing a second-order confirmatory factor analysis. In this analysis, we took the indexes from the exploratory analyses reported in Tables 1–3 as observed variables and the three domains as latent variables. Table 4 presents a correlation matrix for these indexes.

Table 5 presents the results of this confirmatory factor analysis. These analyses were performed with LISREL VI (Jöreskog & Sörbom, 1984). Factor loadings (ksi) are presented for each index. All measures have high loadings in the expected domain, and all are statistically significant. The fit statistics (GFI = .829, χ^2 = 343.02, *df* = 149) indicate that the data fit the model reasonably well, although there is some room for improvement. In addition,

TABLE 3
Results of Factor Analysis of the Outcome Domain

Factors and Items	1	2	3	4	5
Information creation (α = .839)[a]					
The team developed many new ways to look at our task and took an innovative approach to solving the problem.	**.748**	.000	.138	.075	.076
This team made major innovations along the way.	**.696**	.070	.207	−.109	.170
Our team produces an outcome that was greater than the sum of the individual contributions.	**.666**	.207	.054	−.170	.234
The team produces knowledge or information that did not exist before the team was formed.	**.714**	.135	.133	.029	.181
Time compression (α = .745)[a]					
Our team identified ways to speed decisions and remove bureaucratic roadblocks.	**.640**	.035	.048	−.092	.096
Our team has been able to cut the amount of time it takes to accomplish the task.	**.723**	.035	.000	−.015	.215
Working on the team was a slow and cumbersome process.[b]	**.468**	−.054	−.035	.366	−.184
Image expansion (α = .819)					
Participation on this team altered my conception of the complexity of the task.	.174	**.896**	.053	.053	−.076
Participation on this team altered my conception of the scope of the task.	.121	**.903**	.176	.002	.059
Participation on this team altered my conception of the uncertainty associated with the task.	.073	**.881**	−.000	.034	−.038
Learning (α = .730)[a]					
I've developed many new skills from working with members from other functions.	.339	.133	**.645**	.023	.105
I've learned things working in this group that I will use in other groups.	.291	.028	**.685**	−.103	.237
Growth satisfaction (α = .843)[a]					
I am highly satisfied with the personal growth and development I get working on this team.	.260	.039	**.562**	−.358	.054
I get a feeling of worthwhile accomplishment from working on this team.	.385	.038	**.621**	−.216	.047
I have the opportunity for lots of independent thought and action working on this team.	.165	−.060	**.718**	−.099	.001
Overall effectiveness (α = .757)					
We are sometimes told that our team does not produce enough work.[b]	−.105	.142	−.060	**.845**	.068
We are sometimes told that the quality of the work we produce is not satisfactory.[b]	−.195	.152	−.061	**.847**	−.027
The process of this team is effective.	.462	.048	.209	**.519**	.088
Capability development (α = .776)					
Now that our team has worked together for a while, our capacity to do work has improved.	.456	.061	.278	−.298	**.656**
This team keeps getting more effective all the time.	.472	.112	.215	−.253	**.728**
A lot of learning went on in this team.	.221	.211	.477	.076	**.517**
People in our team share their special knowledge and expertise with each other.					**.723**
Eigenvalues	5.580	1.657	1.447	1.292	1.203

[a] When information creation and time compression are combined, α = .862. When learning and growth satisfaction are combined, α = .816.

[b] Item was reverse-coded.

FIGURE 1
A Model of Cross-Functional Team Effectiveness

Context

- Coordination with Other Teams
- Autonomy and Power
- Linkage to Functions
- Resources
- Mission and Direction
- Reward for Team Performance

Process

- Norms
- Importance of Work
- Effort
- Efficiency
- Creative Strategy
- Breadth

Outcomes

- Information Creation
- Time Compression
- Image Expansion
- Learning
- Growth Satisfaction
- Capability Development
- Overall Effectiveness

when the fit of the domain model was compared to the fit of the nested null model, the normed-fit index (Bentler & Bonett, 1980) was .891. The highest modification index value was 22.14 for the satisfaction index and the context domain. No other modification index values exceeded 10.0. No respecification of the model was done since our purpose in this analysis was simply to confirm the plausibility of the three-domain model suggested by the literature and by our qualitative analysis.

DISCUSSION

This study has examined a new, rapidly spreading organizational phenomenon, the cross-functional team, and has developed a grounded model and set of measures of the influences on team effectiveness. This model is framed in terms of the three domains—team context, internal team processes, and team outcomes—that are prominent in current research on team effectiveness. Thus, we have attempted to present a comprehensive model that can be used to inform both future research and practice.

The most original contributions from this research are in the context and outcome domains. In the context domain, a primary contribution is the focus on the highly differentiated organizational environment in which CFTs exist. In particular, the identification of hierarchical, lateral, and function-specific links represents a worthwhile extension of the research presented by other researchers (Ancona, 1990; Ancona & Caldwell, 1992b; Hackman, 1987). The second area of contribution, in the outcome domain, is the identification of a broader set of outcome measures than appears in existing models of team effectiveness. The contributions in the process domain are clearly less unique, but the inclusion of an extensive set of process measures in this context-process-outcome model makes it a useful resource for future researchers and practitioners.

The strengths of this study include its focus on a new and little-understood organizational phenomenon, its grounding in an inductive re-

TABLE 4
Correlation Matrix of Indexes

Index	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Coordination																		
2. Autonomy	.46																	
3. Linkage	.43	.36																
4. Resources	.26	.23	.32															
5. Mission	.48	.39	.35	.21														
6. Reward	.32	.46	.38	.16	.37													
7. Norms	.40	.35	.27	.10	.39	.27												
8. Importance	.54	.49	.38	.15	.52	.65	.41											
9. Effort	.45	.18	.32	.18	.31	.23	.42	.34										
10. Efficiency	.30	.17	.30	−.05	.28	.24	.36	.31	.35									
11. Creativity	.44	.37	.27	.18	.42	.44	.36	.58	.38	.36								
12. Breadth	.61	.42	.37	.26	.53	.36	.36	.60	.39	.35	.57							
13. Information	.43	.39	.32	.22	.41	.50	.42	.61	.35	.35	.68	.66						
14. Time	.50	.40	.33	.17	.41	.41	.47	.64	.42	.36	.65	.60	.68					
15. Image	.14	.23	.06	.06	.24	.20	.01	.29	.12	.09	.13	.29	.25	.23				
16. Learning	.47	.42	.27	.14	.40	.54	.32	.69	.29	.26	.50	.56	.62	.56	.30			
17. Satisfaction	.53	.50	.47	.24	.51	.66	.44	.74	.43	.36	.52	.64	.61	.65	.34	.60		
18. Effectiveness	.44	.36	.43	.18	.42	.31	.38	.41	.39	.37	.38	.49	.45	.48	.08	.33	.51	
19. Capability	.55	.46	.31	.23	.48	.45	.45	.64	.53	.39	.62	.62	.70	.73	.25	.62	.62	.51

TABLE 5
Results of Second-Order Confirmatory Factor Analysis

Index	Context ksi 1	Process ksi 2	Outcome ksi 3
Coordination	.72	.00	.00
Autonomy	.62	.00	.00
Linkage	.54	.00	.00
Resources	.31	.00	.00
Mission	.65	.00	.00
Reward	.63	.00	.00
Norms	.00	.53	.00
Importance	.00	.81	.00
Effort	.00	.51	.00
Efficiency	.00	.43	.00
Creativity	.00	.71	.00
Breadth	.00	.76	.00
Information	.00	.00	.80
Time	.00	.00	.81
Image	.00	.00	.31
Learning	.00	.00	.73
Satisfaction	.00	.00	.82
Effectiveness	.00	.00	.59
Capability	.00	.00	.83

search process, the generality of findings across a wide variety of teams, and the application to an intact set of product development teams. Potential limitations of the study include the fact that the data were all collected from a single organization and that the final validation of the measures reported here relied upon a sample of one type of CFT, product development teams. Although the data summarized here represent literally hundreds of teams and contexts from many different countries, future validation of this model would benefit by using data from multiple organizations. The focus on product development teams, on balance, may also be more of a strength than a limitation, since such teams are one of the most demanding forms of cross-functional team (Nonaka, 1991). In addition, such teams are of continuing interest to group researchers (Ancona, 1990; Ancona & Caldwell, 1992b; Donnellon, 1995) and figure in important ways in the future research agenda in this area.

Several relationships identified in the model suggest important future research. Three examples help to illustrate: First, the results suggest that information creation and time compression are closely related. This finding appears to contradict traditional group research on speed and innovation and tends to support Eisenhardt's (1989) observation that innovation and speed can occur jointly. This issue clearly warrants further analysis. Second, more general questions in the literature can also be addressed within this model. For example, Gladstein (1984) and Ancona (1990) studied the relationship between organizational context and team processes, concluding that contextual factors were more important determinants of team effectiveness than team process. The broad definition of context, process, and outcomes in this model provides the basis for a more robust test of the relative influences of context and process on outcomes.

Third, the multidimensional definition of the outcome domain suggests another interesting set of research questions. For example, several of the dimensions, such as time compression, task achievement, and information creation, are task-focused and relatively short-term. Other outcome dimensions, such as learning, capability development, image expansion, and growth satisfaction, are longer-term contributions to the future capacity of the organizational system. Are different aspects of context and process associated with these different types of outcomes? Do they differ in their prediction of "objective" indicators of performance and effectiveness?

This study also collected data about the specific functional organizations represented by each of the team members. Thus, we could aggregate the data presented in this study by function rather than by team to create measures of the linkage problems associated with each specific functional organization. The presentation of these data would be well beyond the scope of this article, but the availability of quantitative and qualitative data about each of the functions that assign members to these teams offers an alternative way for future research to examine the multifaceted context in which teams exist.

A final important issue for future research is the effect of different structural arrangements on team effectiveness (Galbraith & Kazanjian, 1986; Gobeli & Larson, 1987). Cross-functional teams can, for example, exist within a matrix structure, with part-time commitment and temporary assignment of members to teams, or within a more autonomous team structure in which team assignments are full-time and long-term. The alleged merits and dynamics of more fully dedicated teams are the subject of heated debate in the literature (Clark & Fujimoto, 1987, 1991; Denison, Hart, & Ichijo, 1994; Takeuchi & Nonaka, 1986) and among practitioners, but very few data currently exist to inform these discussions.

This brief discussion of the future research agenda reveals only a few of the many interesting research topics that can inform the theoretical and practical understanding of cross-functional teams. Since the evolution of these teams in organizations is rapidly outstripping scholarly research on the topic, this situation represents a unique opportunity to researchers who aspire to inform both theory and practice.

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DOES ISOMORPHISM LEGITIMATE?

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This study tests a central proposition of institutional theory, that organizational isomorphism increases organizational legitimacy. Results show that isomorphism in the strategies of commercial banks is related to legitimacy conferred by bank regulators and the media, even in the presence of organizational age, size, and performance.

Research in institutional theory has examined the causes of isomorphism, that is, the factors that lead organizations to adopt similar structures, strategies, and processes (Davis, 1991; DiMaggio & Powell, 1983; Mezias, 1990; Palmer, Jennings, & Zhou, 1993; Tolbert & Zucker, 1983). Isomorphism also has consequences that require examination (Jepperson, 1991; Zucker, 1987). A fundamental consequence of institutional isomorphism, according to institutional theory, is organizational legitimacy, the acceptance of an organization by its external environment (DiMaggio & Powell, 1983; Meyer & Rowan, 1977; Meyer & Scott, 1983). Like isomorphism, legitimacy is a crucial concept in institutional theory, serving as the "anchor-point of a vastly expanded theoretical apparatus" (Suchman, 1995: 571). Nevertheless, there have been few systematic efforts to test the isomorphism-legitimacy link because of continuing difficulties in defining and measuring legitimacy (Bozeman, 1993; Galaskiewicz, 1985; Suchman, 1995; Terreberry, 1968). This study addresses these gaps in institutional research by examining whether isomorphism in strategies is related to legitimacy conferred by regulators and the media.

HYPOTHESIS DEVELOPMENT

Organizational isomorphism (isomorphism, hereafter) is defined as the resemblance of a focal organization to other organizations in its environment (DiMaggio & Powell, 1983). Although DiMaggio and Powell discussed isomorphism as both a state and a process, I conceptualize it here as a state. That is, this article focuses on isomorphism as the similarity among a set of organizations at a given point in time.

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Researchers have identified several organizational characteristics that are subject to isomorphism. Initial concerns were with structures and practices (Meyer & Rowan, 1977; Tolbert & Zucker, 1983). Recently, strategies have been examined. For example, Fligstein (1991), Haunschild (1993), Haveman (1993), and Abrahamson and Hegeman (1994) demonstrated the importance of imitating other firms (i.e., mimetic isomorphism) in the choice of acquisition, diversification, and financial strategies. This study focuses on strategic isomorphism, the similarity of a focal organization's strategy to the strategies of other organizations in its industry.

As was true regarding isomorphism, legitimacy can be conceptualized as both a process and a state. Here I emphasize the latter. Legitimacy also can be conceptualized from an evaluative perspective, signifying desirability and normativity, or from a cognitive perspective, signifying understandability and taken-for-grantedness (Aldrich & Fiol, 1994; Jepperson, 1991; Suchman, 1995). Here I emphasize the evaluative perspective.

Organizational legitimacy (legitimacy, hereafter) is defined as a status conferred by social actors (Ashforth & Gibbs, 1990; Pfeffer & Salancik, 1978). From the perspective of a particular social actor, a legitimate organization is one whose values and actions are congruent with that social actor's values and expectations for action (Galaskiewicz, 1985; Pfeffer & Salancik, 1978). The social actor accepts or endorses the organization's means and ends as valid, reasonable, and rational (Ashforth & Gibbs, 1990; Baum & Oliver, 1991; Meyer & Scott, 1983; Singh, Tucker, & House, 1986; Stinchcombe, 1968).

Given that legitimacy is the endorsement of an organization by social actors, a key step in defining it is identifying relevant social actors. In this research I follow Meyer and Scott (1983), Galaskiewicz (1985), and Baum and Oliver (1991) in arguing that only certain actors have the standing to confer legitimacy. One important set of actors includes the government regulators who have authority over an organization (Baum & Oliver, 1991; Galaskiewicz, 1985; Meyer & Scott, 1983). A second key actor is public opinion, which has the important role of setting and maintaining standards of acceptability (Elsbach, 1994; Galaskiewicz, 1985; Meyer & Rowan, 1977; Meyer & Scott, 1983).

Thus, this article focuses on two types of legitimacy by examining the evaluations of two social actors, government regulators and the general public. *Regulatory endorsement* is the acceptance of an organization by the state agencies that formally regulate it. *Public endorsement* is the acceptance of an organization by the general public.

Theoretically, strategic isomorphism increases regulatory endorsement and public endorsement in the following way. In most industries, particular strategies are not required. Instead, ambiguity and uncertainty make the choice of appropriate strategies unclear (Abrahamson & Hegeman, 1994; Haveman, 1993). Consequently, organizations create norms of strategic behavior that social actors also come to accept (DiMaggio & Powell, 1983; Edelman, 1992). Proper strategic behavior diffuses across an industry in at least two related ways. First, organizations imitate other successful organizations in the face of uncertainty (DiMaggio & Powell, 1983; Haveman, 1993). Second, organizations learn about proper behavior through trade associations, director linkages, and other networks (DiMaggio & Powell, 1983; Galaskiewicz & Wasserman, 1989; Haunschild, 1993). On the one hand, an organization conforming to norms of strategic behavior demonstrates that it is acting in an acceptable manner and social actors should evaluate it as legitimate (Meyer & Rowan, 1977). On the other hand, organizations that innovate or have unique strategies suffer in terms of legitimacy—such behavior is questioned or even deemed unacceptable by external actors (Meyer & Rowan, 1977). In sum, this study tests whether strategic behavior deviating from the norm is related to negative evaluations of organizations made by regulators and the general public. Stated formally,

> *Hypothesis 1: Greater strategic isomorphism is associated with greater regulatory endorsement.*
>
> *Hypothesis 2: Greater strategic isomorphism is associated with greater public endorsement.*

METHODS

The hypotheses were tested in the entire population of commercial banks in the Minneapolis-Saint Paul metropolitan area (the Twin Cities) from 1985 through 1992. Commercial banks are chartered by regulators and differ from bank holding companies, which can own several financial service businesses. Hypotheses derived from institutional theory should hold in this sample because commercial banks face strong institutional forces (Scott & Meyer, 1991). For instance, banks face periodic scrutiny from regulators (Spong, 1990); banks also have a high degree of public trust (Ashforth & Gibbs, 1990). Furthermore, commercial banks are in the for-profit sector of the economy, which Powell (1991) recommended as an area for expanded empirical study. Moreover, studying a single industry in a single area eliminates confounding influences of different regulators and publics. I chose 1985 as the initial year because regulators changed reporting requirements in 1984 for the financial data used. All banks are required to file financial statements known as call reports with bank regulators. I collected the sample of banks and their year-end financial data from these reports. The number of banks ranged from 152 in 1985 to 95 in 1992. The unit of analysis was the bank-year.

Measures

Regulatory endorsement. Regulators evaluate commercial banks in two important ways: by examining banks' financial capital and by examining them on-site (Spong, 1985, 1990). A bank's financial capital position reflects its ability to protect depositor savings. Regulators assess this ability by classifying the bank's capital position into three ordered discrete categories. Banks in lower categories are not fully endorsed by the regulators. These banks instead are subject to increased regulatory scrutiny. The classification of banks used the capital ratios and categories specified by regulatory agencies

(Spong, 1985, 1990). A minor complication is that regulators changed the capital ratio and categories used for classification during the sample period. From 1985 through 1988, they used the "total capital ratio"; from 1989 through 1992, they adopted the "tier 1 leverage ratio." (The definitions of these ratios and classification schemes appear in Appendix A.) The resulting variables are called *regulatory assessment of total capital, 1985–88* and *regulatory assessment of tier 1 leverage capital, 1989–92.* They are coded (0, 1, 2), with fully endorsed banks having the highest coding (2).[1]

Regulators make on-site examinations to ascertain the safety and soundness of a bank's assets. When their examinations reveal that a bank has low-quality assets and is following unsafe banking practices, regulators issue enforcement actions. Enforcement actions require the bank to take certain actions, such as curtailing lending to a certain industry or firing top management. Information about such enforcement actions only became publicly available in 1991, by congressional statute. I obtained the record of enforcement actions from LEXIS, a legal database, and created a dichotomous variable called *absence of regulatory enforcement actions, 1991–92.* Banks not subject to an enforcement action during a year were given a rating of 0; banks under an enforcement action were given a −1.

Public endorsement. I measured public endorsement from articles in the print media using content analysis. Media influence and reflect the values of a culture (Chen & Meindl, 1991; Dowling & Pfeffer, 1975; Gans, 1979). When activities of an organization are illegitimate, comments and attacks will occur, and the media will report such comments (Dowling & Pfeffer, 1975; Pfeffer & Salancik, 1978: 194). Researchers are beginning to use the media to measure legitimacy. For example, Hybels, Ryan, and Barley (1994) content-analyzed business periodical abstracts to assess the legitimacy of the population of "dedicated" biotechnology firms. Coombs (1992) content-analyzed the *New York Times* and the *Washington Post* to assess the legitimacy of President Reagan's Task Force on Food Assistance.

The Twin Cities' two metropolitan daily newspapers, the *Minneapolis Star Tribune* and the *Saint Paul Pioneer Press,* were sampled from 1988 to 1992. In a national survey, Stempel (1991) found that 67.3 percent of the population got their news about local businesses from the local newspaper. In contrast, the percentages using television, other people, and radio were much lower (27.0, 22.2, and 10.1%, respectively). Furthermore, audience recall of information contained in newspapers exceeds the recall of information from television and radio (DeFleur, Davenport, Cronin, & DeFleur, 1992). These two papers have the largest circulations in the area and thus should represent Twin Cities' public opinion. I selected 1988 as the first year of data collection for two reasons related to measurement accuracy. First, coding

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[1] After collecting the data, I discovered that there was no variation in the regulatory assessment of tier 1 leverage capital, 1989–92, among Twin Cities banks. All banks were fully endorsed. Consequently, this measure received no further statistical attention.

First Bank and Norwest Bank, the two largest area banks, would have been problematic for the period before their consolidation of their numerous banking units, which occurred at the beginning of 1988. For instance, before 1988 "First Bank" could refer to First Bank Lake, First Bank Grand, or several other independent banks. Thus, measurement accuracy could be reduced for these banks. Second, costs in time and money are important influences on sampling design (Sudman, 1976). I chose to focus the sampling effort on ensuring accuracy within years rather than increasing breadth across years.

The sample of articles included all letters to the editor, all editorials, all columns, and a stratified sample of news articles. All letters, editorials, and columns were included because they represent interpretations of organizations that are important for conferring legitimacy (Dowling & Pfeffer, 1975; Pfeffer & Salancik, 1978). News articles reflect daily events and often come from press releases. I selected all news articles for each bank with fewer than eight articles in a year. For banks with more than eight, I randomly selected a total of eight plus 25 percent of the remaining number of articles. A sampling fraction of 25 percent is well above that used in most communication research (e.g., Krishnaiah, Signorielli, & McLeod, 1993; Riffe, Aust, & Lacy, 1993). Such research usually examines one or two well-covered topics over time. In contrast, this study looked at over 95 banks, many of which had little or no press coverage. In total, this procedure yielded 1,277 articles.

Coding the articles entailed identifying and rating recording units (Weber, 1990). A recording unit comprised an individual bank in a single article. Because several articles mention many banks, 2,150 recording units were identified. Each recording unit was rated as endorsing or challenging the subject bank's legitimacy (Ashforth & Gibbs, 1990; Hirsch & Andrews, 1984). I developed a coding scheme to rate each recording unit. Appendix B contains the terms and activities that challenged a bank's legitimacy.

All articles were coded by the author. A colleague was instructed to use the same coding scheme on 23 percent (52) of the articles from one year. The two raters agreed on 68 of the 71 recording units (95.8%), suggesting high levels of intercoder reliability (Weber, 1990).

The next step was to transform the recording units into a measure suitable for statistical analysis. The Janis-Fadner coefficient of imbalance was used to create annual measures of public endorsement for each bank (Budd, Thorp, & Donohew, 1967; Coombs, 1995; Hurwitz, Green, & Segal, 1976; Janis & Fadner, 1965). As implemented here, the coefficient measures the relative proportions of endorsing and challenging recording units for each bank in a year. The formula for its calculation is in Appendix C. I labeled this variable the *coefficient of media endorsement.* This coefficient has many useful properties, such as (1) a meaningful zero point when there are equal numbers of endorsing and challenging recording units, (2) a decrease in the coefficient when the number of challenging recording units increases, and (3) an increase in the coefficient when the number of endorsing recording units increases (Budd et al., 1967; Janis & Fadner, 1965). The measure is bounded by 1 and −1.

Strategic isomorphism. Strategic isomorphism was measured using *strategic conformity,* the extent to which an organization's strategies resembled the conventional, normal strategies in an industry (Abrahamson & Hegeman, 1994; Finkelstein & Hambrick, 1990). Bank asset strategies were the key strategy variables used to measure strategic conformity. An asset strategy is the allocation of resources to a certain market (Chandler, 1962). It is measured here as a proportion of total assets. For example, the commercial lending strategy is measured as the proportion of assets that a bank commits to commercial loans. Eleven bank asset strategy variables were included here: commercial loans, real estate loans, loans to individuals, agriculture loans, other loans and leases, cash, overnight money, securities, trading accounts, fixed assets, and other assets. Haveman (1993) and Reger, Duhaime, and Stimpert (1992) used similar categories.

I computed strategic conformity following Finkelstein and Hambrick (1990). Each key asset strategy for each bank was compared to the industry mean value for that variable and expressed as a standard deviation. The absolute values of the standard deviations for all the strategy variables were totaled for each bank, giving a holistic and parsimonious measure of deviation. Multiplying by -1 created a scale on which more positive numbers indicate greater conformity.

Organizational Attributes: Age, Size, and Performance

In addition to isomorphism, the organizational attributes of age, size, and performance have been suggested by researchers as potentially important determinants of legitimacy.[2] Older organizations are more likely to (1) develop strong exchange relationships, (2) become part of a power hierarchy, (3) be endorsed by powerful social actors, and (4) have an "aura of inevitability" (Hannan & Freeman, 1984: 158; Singh et al., 1986). "Nothing legitimates both individual organizations and forms more than longevity" (Hannan & Freeman, 1984: 158). I obtained the founding year for each bank from *Polk's Bank Directory,* a semiannual standard reference of banks.

Legitimacy may also be affected by an organization's size. Larger firms may have more contractual and social ties to and endorsements from actors in their external environments (Galaskiewicz, 1985; Pfeffer & Salancik, 1978; Singh et al., 1986). I measured size using total average assets from the call reports (cf. Haveman, 1993).

Performance also might affect legitimacy. Firms performing well are efficient at converting resources into goods and services, and society values such efficiency (Dowling & Pfeffer, 1975; Meyer & Rowan, 1977). Consistent with bank regulatory practice, return on average assets (ROA) from the call reports was the measure of performance used here.

Analysis

There were two types of dependent variables, each requiring a different analytic technique. I tested the regulatory endorsement variables, which are ordered categorical variables, using logistic regression analysis (Fienberg, 1980; Greene, 1993; Maddala, 1983). The coefficient of media endorsement is bounded and may have many observations at the boundaries. It was estimated with censored regression (the "tobit" model; Amemiya, 1984; Greene, 1993; Maddala, 1983). The following equation is the general statistical model used for testing the models:

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[2] I thank an anonymous reviewer for recommending the inclusion of performance.

$$\begin{aligned}\textit{Endorsement} = {} & b_0 + b_1 \times \textit{strategic conformity} + b_2 \times \textit{age} + b_3 \times \textit{size} \\ & + b_4 \times \textit{performance} + e.\end{aligned}$$

RESULTS

Table 1 displays the descriptive statistics for the variables, including the frequencies of the regulatory endorsement measures. Of the observations for the 1985–88 regulatory assessment of total capital, 84.1 percent scored a 2, the highest level. Of the observations for the absence of regulatory enforcement actions, 1991–92, 95.4 percent scored a 0, the higher level, indicating that the observed banks did not have actions against them. For the coefficient of media endorsement, only 269 of the observations (50.6%) received press coverage in 1988–92. Of these, 78.4 percent scored a 1, meaning these banks had only endorsing coverage.

Table 2 shows the correlations among the variables. The number of observations for each correlation varies because of the different sample periods used for each legitimacy measure. The coefficient of media endorsement is positively correlated with the two regulatory measures.

Table 3 displays the results of the hypothesis testing. Standardized coefficients are reported. The first two models examine regulatory endorsement. Model 1 estimates the regulatory assessment of total capital, 1985–88, for which there were 554 observations. Strategic conformity had a significantly positive coefficient ($\beta = 0.371, p < .01$), supporting Hypothesis 1. The coeffi-

TABLE 1
Descriptive Statistics

				Frequency			
Variables	*N*	Mean	s.d.	−1	0	1	2
Regulatory assessment of total capital, 1985–88	554	1.81	0.46		16	72	466
Absence of regulatory enforcement actions, 1991–92	194	−0.05	0.21	9	185		
Coefficient of media endorsement, 1988–92	269	0.87	0.31				
Strategic conformity, 1985–92	969	−7.68	2.96				
Age, 1985–92	969	53.32	33.40				
Size, 1985–92[a]	969	277.85	1,436.02				
Performance, 1985–92	969	0.01	0.01				

[a] Size is expressed in millions of dollars.

TABLE 2
Correlations[a]

Variables	1	2	3	4	5	6	7
1. Regulatory assessment of total capital, 1985–88	1.00						
	0.00						
	554						
2. Absence of regulatory enforcement actions, 1991–92	[b]	1.00					
		0.00					
		194					
3. Coefficient of media endorsement, 1988–92	0.20	0.33	1.00				
	0.16	0.00	0.00				
	52	95	269				
4. Strategic conformity, 1985–92	0.16	0.17	0.12	1.00			
	0.00	0.02	0.06	0.00			
	554	194	269	969			
5. Age, 1985–92	0.04	−0.01	−0.10	−0.09	1.00		
	0.39	0.86	0.08	0.00	0.00		
	554	194	269	969	969		
6. Size, 1985–92[c]	−0.03	0.01	−0.18	−0.44	0.29	1.00	
	0.48	0.85	0.00	0.00	0.00	0.00	
	554	194	269	969	969	969	
7. Performance, 1985–92	0.31	0.20	−0.04	0.17	0.05	−0.06	1.00
	0.00	0.01	0.52	0.00	0.10	0.04	0.00
	554	194	269	969	969	969	969

[a] Correlation (r), p-value for $H_0 <> 0$, and number of observations are in each cell.

[b] The value is undefined for this measure because data for the two variables were not available for the same years.

[c] Size is expressed in millions of dollars.

TABLE 3
Results of Logistic and Censored Regression Analyses[a]

Independent Variables	Model 1: Regulatory Assessment of Total Capital, 1985–88		Model 2: Absence of Regulatory Enforcement Actions, 1991–92		Model 3: Coefficient of Media Endorsement, 1988–92	
	β	s.e.	β	s.e.	β	s.e.
Intercept 1	1.754***	0.126	3.351***	0.425	1.291***	0.043
Intercept 2[b]	3.754***	0.270				
Strategic conformity	0.371**	0.127	0.543†	0.296	0.045*	0.022
Age	0.022	0.128	−0.091	0.342	−0.145***	0.036
Size	0.185	0.130	0.182	0.562	−0.038*	0.019
Performance	0.549***	0.103	0.735*	0.346	−0.003	0.029
−2 log-likelihood	525.088		63.670		233.911	
Log-likelihood improvement $\chi^2(4)$	43.387***		9.178†			
Score improvement $\chi^2(4)$	47.584***		12.231*			
Sample size	554		194		269	

[a] Models 1 and 2 are logistic regression analyses; model 3 is a censored regression analysis.

[b] The second intercept is present in this model because the ordered dependent variable has three categories. The logistic procedure fits a parallel lines regression model for each category. The intercept reflects the cumulative probability for all categories below the category under consideration. Thus, the number of intercepts in these logistic models is one less than the number of categories (cf. Maddala, 1983: 46–47).

† $p < .10$

* $p < .05$

** $p < .01$

*** $p < .001$

cient for performance was also positive and significant ($\beta = 0.549, p < .001$). The coefficients for age and size were not significant.

Model 2 estimates the absence of regulatory enforcement actions, 1991–92, for which there were 194 observations. Strategic conformity had a positive coefficient ($\beta = 0.543$) that was significant at the $p < .07$ level, providing modest support for Hypothesis 1. Performance again had a significantly positive coefficient ($\beta = 0.735, p < .05$). Age and size again were not significant.

Model 3 of Table 3 estimates the coefficient of media endorsement, 1988–92, for which there were 269 observations. Strategic conformity had a significantly positive coefficient ($\beta = 0.045, p < .05$), supporting Hypothesis 2. Age had significantly negative coefficient ($\beta = -0.145, p < .001$) as did size ($\beta = -0.038, p < .05$). Performance had no effect.

DISCUSSION AND CONCLUSION

The results constitute the first systematic tests of a fundamental linkage in institutional theory. Evidence suggests a positive relationship between strategic isomorphism and multiple measures of legitimacy, even when age, size, and performance are included. The findings support the general proposition made by Meyer and Rowan (1977) and DiMaggio and Powell (1983) stating that organizational isomorphism increases organizational legitimacy. Organizations that conform to the strategies used by other organizations are recognized by regulators and the general public as being more legitimate than those that deviate from normal behavior.

This study also demonstrated how organizational legitimacy could be operationally defined using regulators and the media as sources. Researchers have called for more empirical attention to legitimacy for decades (Bozeman, 1993; Galaskiewicz, 1985; Suchman, 1995; Terreberry, 1968). This lack of attention is especially disappointing because legitimacy is an "anchor-point" concept on which many propositions of institutional theory are based (Suchman, 1995: 571). The operational definitions developed here could be applied in other settings, with appropriate contextual modifications.

The results also suggest that regulators and the media confer legitimacy in different ways. The correlations between the measures of regulatory endorsement and public endorsement were lower than .34. Moreover, the pattern of the regression coefficients for the independent variables differed. Future research should examine in more depth how regulators and the media confer legitimacy. At a more general level, institutional theorists should refine their propositions involving legitimacy to recognize that there are different types and sources of legitimacy (Galaskiewicz, 1985; Suchman, 1995).

The specific results for the independent variables suggest avenues for future research into the other determinants of legitimacy. The differential regression results stemmed from organizational age, size, and performance.[3]

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[3] Statistical comparison of coefficients between regulatory endorsement and public endorsement estimations is inappropriate because the analysis techniques differed.

Age and size are discussed together because of the common patterns in their results.

Age and size had no significant effect on regulatory endorsement. These findings suggest that regulators do not consider these factors important in judging bank safety and soundness. Although regulators had slightly more liberal capital standards for large banks in the 1985–88 period, as illustrated in Appendix A, this differential was removed in the 1989–92 period. Age and size may have little impact on evaluations by state regulators in other industries.

However, larger and older banks had lower levels of media endorsement. This is somewhat surprising for at least two related reasons. First, larger and older organizations have more social and economic ties to their environment (Pfeffer & Salancik, 1978). Second, they have a longer history of interactions with their environment (Hannan & Freeman, 1984). One explanation is that the public may hold higher standards for the larger banks, because of their greater impact and visibility in the community. The larger banks tended to be the older ones as well, as evident in the 0.29 correlation between age and size in Table 2. An alternative explanation is that larger banks receive more newspaper coverage, and this increases the likelihood that challenging newspaper stories about them will appear. Only 11 percent of the recording units in this sample challenged banks' legitimacy. Banks that have more stories about them would be more likely to have legitimacy-challenging stories, ceteris paribus. Although larger and older banks had lower media endorsement scores, these banks still were endorsed by the public. Their coefficients of media endorsement were greater than zero, meaning they had more endorsing recording units than challenging ones. Overall, a greater understanding of the relationship between the media and business organizations will further theories of public endorsement.

Performance had a positive relationship with regulatory endorsement. This is not surprising given regulators' interest in banks' solvency. More profitable banks tend to increase their capital. Moreover, regulatory examinations would find the banks had better-quality assets, so enforcement actions would be less likely. Lower performance did not, however, result in challenges to a bank by the media. A possible explanation is that the media did not attend to differences in bank performance unless a bank was losing money. I examined this possibility post hoc by splitting the sample into banks that were making money (i.e., had a positive ROA) and those that were not. A t-test showed no difference in the coefficient of media endorsement between the two groups ($t = 0.51$, $df = 37$, $p = .62$). Clearly, the relationship between performance and public endorsement requires further study.

A limitation is that the sample population contained only commercial banks. Nevertheless, the inferences drawn here may apply to other organizations in strong institutional environments, such as hospitals and universities (Scott & Meyer, 1991). Another limitation is that only strategic isomorphism was examined. Future work should examine the effect on legitimacy of other types of isomorphism, such as structural and procedural isomorphism (Scott, 1987). Also, only two social actors conferred legitimacy, regulators and the media. Future work should examine other sources of legitimacy, such as intellectuals and funding agents (Galaskiewicz, 1985). Finally, the causal direction of the independent variables and legitimacy has been assumed to be in the direction predicted by institutional theory. Strong causal inference from these results would be inappropriate, given the cross-sectional design.

In sum, this study empirically answers yes to the question raised in the title—Does isomorphism legitimate?—given the aforementioned caveats. This affirmation for isomorphism in strategies extends across two sources of legitimacy, regulators and the media.

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APPENDIX A
Regulatory Rules for Classifying Banks' Capital Positions[a]

Regulatory Assessment of Total Capital, 1985–88

$$\textit{Total capital ratio} = \frac{\begin{array}{c}\textit{(total equity capital + limited life preferred stock +}\\ \textit{subordinated notes and debentures + minority interests in}\\ \textit{consolidated subsidiaries + allowance for loan and lease losses)}\end{array}}{\textit{(total assets + allowance for loan and lease losses)}}$$

Categories

2 = Banks with a total capital ratio greater than 7.0 percent and total average assets less than \$1 billion, or banks with a total capital ratio greater than 6.5 percent and total average assets of \$1 billion or more.

1 = Banks with a total capital ratio between 7.0 percent and 6.0 percent inclusive and total average assets less than \$1 billion, or banks with a total capital ratio between 6.5 percent and 5.5 percent inclusive and total average assets of \$1 billion or more.

0 = Banks with a total capital ratio less than 6.0 percent and total average assets less than \$1 billion, or banks with a total capital ratio less than 5.5 percent and total average assets of \$1 billion or more.

Regulatory Assessment of Tier 1 Leverage Capital, 1989–92

$$\textit{Tier 1 leverage capital ratio} = \frac{\textit{(total equity} - \textit{goodwill)}}{\textit{(total assets} - \textit{goodwill)}^{b}}$$

Categories

2 = Banks with tier 1 leverage capital ratio greater than or equal to 3.0 percent.

1 = Banks with tier 1 leverage capital ratio less than 3.0 percent and greater than or equal to 2.0 percent.

0 = Banks with tier 1 leverage capital ratio less than 2.0 percent.

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[a] Source is Spong (1985, 1990).

[b] From an accounting perspective, goodwill is the excess cost of an acquired bank over the fair market value of its assets less its liabilities.

APPENDIX B
Classification of Recording Units

Legitimacy-Challenging Terms

Adjectives: Bad, clubby, confusing, disingenuous, hostile, misguided, reckless, speculative, unpopular.

Nouns: Big Cigars, corruption, criticism, disappointment, dyspepsia, empire of Genghis Khan, extremely tight credit leash, failure, gamble, golden parachute, greed, iron triangle, moguls, Pharaohs, ploy, ransoms, trouble, woes.

Verbs: Blame, chide, complicate, defended (the action against criticism), failed, justified, loses, obscure, oppose, placate, redlining, sour, tried to explain, unsure of what the bank would do.

Activities That Challenge Legitimacy

Court action in which the bank is a defendant.

Failure of a bank and possible reasons.

Public relations activity suggestive of spin doctors used with verbs such as "tried to explain" as listed above.
Regulatory action denying a bank regulatory request.
Regulatory action penalizing a bank, often a fine or an enforcement action.

APPENDIX C
Formula for the Coefficient of Media Endorsement[a]

$$\textit{Coefficient of media endorsement} = \begin{cases} \frac{(e^2 - ec)}{t^2} \text{ if } e > c, \\ \frac{(ec - c^2)}{t^2} \text{ if } c > e, \\ 0 \text{ if } e = c, \end{cases}$$

where

e = number of endorsing recording units in a given year,
c = number of challenging recording units in a given year,

and

$t = e + c$.

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[a] Sources are Budd, Thorp, and Donohew (1967) and Janis and Fadner (1965).

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CUSTOMER PERCEPTIONS OF CORPORATE RESPONSES TO PRODUCT COMPLAINTS: THE ROLE OF EXPLANATIONS

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Using the justice and impression management literatures as a guide, we examined company responses to customer complaints in a field study. Explanations in which a company accepted responsibility for a problem resulted in the most favorable pattern of complainant reactions. Inclusion of coupons or other reimbursements also led to more favorable reactions. Favorable reactions were muted when the product in question was expensive or when the company was perceived to be tardy in responding to a complainant.

Organizations face increasing costs as they seek to both attract new customers and maintain profitable relationships with existing ones (Rapp & Collins, 1987). The quality of a company's relationship with customers is a central determinant of its long-term viability. Like any social exchange process, the relationship between organization and customer may become strained when an item exchanged does not perform to expectations. Customers who are unhappy with products they purchase usually respond in one of two ways. Many customers "lump it" and choose not to voice their complaint to the organization (Best & Andreasen, 1977). Other customers voice their annoyance by writing to the corporation regarding the product. Organizations concerned with satisfying and keeping their customers typically respond to these complainants. However, little is known about how best to manage this process from an organization's perspective. What actions are most likely to turn dissatisfied customers into satisfied customers and keep them committed to the company through continued purchase of its products? What company statements are likely to produce the most favorable pattern of reactions in customers?

In this study we relied on the justice and impression management literatures to develop hypotheses related to the customer complaint context. Specifically, we examined in a field study how (1) the type of explanation a

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company provided, (2) the presence of compensation, (3) problem severity, and (4) the speed of the company's reply affected customer perceptions of the explanation, product, and company. We begin with an overview of the customer complaint process and then show the relevance of the justice and impression management literatures for furthering researchers' understanding of complainants' reactions to corporate responses to their complaints.

CUSTOMER COMPLAINTS AND THE MANAGEMENT OF FAVORABLE IMPRESSIONS

Although there is a substantial literature on customer dissatisfaction and complaint behavior (e.g., Bearden & Teel, 1983; Churchill & Surprenant, 1982; Folkes, 1984, Richins, 1983), little attention has been paid to corporate responses to individual customer complaints or to customer perceptions of those responses. Best and Andreasen (1977) suggested that the life cycle of customer complaints can be divided into three stages: perceiving a problem, voicing a complaint, and resolving the complaint. These three stages nicely parallel the sequence of actions followed by people who decide to file a legal claim or lawsuit (Sheppard, Lewicki, & Minton, 1992). Felstiner, Abel, and Sarat (1980–81) referred to these three stages as "naming," "blaming," and "claiming." These similarities suggest that the justice literature may offer considerable insight into the customer complaint process. This literature suggests that individuals are concerned not only with the perceived fairness of the *outcome* they receive from a particular encounter, but also with the perceived fairness of the *process* used to resolve conflicts or administer rewards. These two concerns are referred to as *distributive* and *procedural* justice, respectively.

An impressive body of work has shown that people prefer resolutions of conflicts that enhance perceptions of procedural and distributive justice to those that do not (Lind & Tyler, 1988). These patterns have recently been extended to a variety of organizational contexts, including performance evaluations (e.g., Greenberg, 1986), pay raise decisions (e.g., Folger & Konovsky, 1989), and the effects of downsizing on employees who remain with a company (e.g., Brockner, DeWitt, Grover, & Reed, 1990). Research on justice would seem to be ripe for application to the customer complaint process, as it has been successfully applied to other individual-organization procedures with conflict potential (e.g., Conlon, 1993). We reasoned that if the justice model could be applied to customer-organization relationships, then situations in which the customer perceives that company procedures or responses are unfair or inappropriate could be construed as a type of injustice, and subsequent customer reactions could be predicted by the model.

The Role of Explanations

A company that receives a complaint about a product finds itself in the position of having to substantiate or legitimate its claim to its image (Greenberg, 1990; Schlenker, 1980). The extent of the predicament depends on the severity of the problem and on the degree to which the company is viewed as being responsible. Writing about procedural justice, Bies (1987), Greenberg (1990), and others have argued that managers often use explanations to reduce the negative consequences inherent in certain types of organizational actions. We suspect that in the customer complaint context, a company is likely to use a similar set of tactics in an attempt to defend its reputation as a producer of quality products and keep the complainant committed to purchasing the company's products or services.

Greenberg (1990), drawing on the work of Scott and Lyman (1968), discussed three specific types of explanations that may be used to manage or reclaim a favorable impression. The first of these types, *excuses*, can be defined as explanations that remove the organization from responsibility for its predicament. For example, a frozen pizza manufacturer who receives a complaint about the taste of a pizza from a customer may state in a reply letter that the pizza was fine when it left the factory, but "often times the pizza is not kept at a suitably cold temperature at the local grocer," thereby providing an account that lessens the manufacturer's responsibility for the problem and assigns blame to the retailer. Thus, in our customer complaint context, an excuse does not minimize the severity of the problem, but it does attempt to lessen the organization's responsibility for the problem.

A second type of explanation organizations may use in writing to customers is an *apology*. Apologies can be defined as "confessions of responsibility for negative events which include some expression of remorse" (Tedeschi & Norman, 1985: 299). The goals of an apology in our customer complaint context are (1) to inform the customer that the organization accepts responsibility for the event, and (2) to express sincere regret.

Both excuses and apologies include an acknowledgment of the existence of a problem, though excuses deny responsibility for the problem and apologies accept responsibility. *Justifications* are explanations in which the organization accepts responsibility for the event but at the same time denies that the event has the negative quality attached to it. Returning to our pizza example, a justification from the pizza manufacturer might argue that market research shows that most people prefer a spicy, distinctive sauce for their pizza, while recognizing that some people (such as the complainant) will be unhappy with the taste. Thus, justifications can include a rationalization admitting that some people may have a negative reaction, but arguing that the majority will benefit (or, in a downsizing context, that the best interests of the company as a whole are served, even though some individuals may suffer or be inconvenienced). It seems reasonable to presume that all three explanations have as their ultimate goal the maintenance of positive customer attitudes toward both the company and its products.

Explanations have received considerable attention recently in the organizations literature (e.g., Crant & Bateman, 1993; Elsbach, 1994; Shapiro, Buttner, & Barry, 1994). Past research suggests that appropriate explanations can reduce feelings of anger and resentment that often occur when people experience unfavorable events and enhance perceptions that the procedures used were fair (Bies & Shapiro, 1987; Folger, Rosenfield, & Robinson, 1983). Bies and Shapiro (1987) found that the presence of a justificatory explanation led to greater ratings of fairness than the identical outcome without an explanation. Greenberg (1990) reviewed evidence that workers who received an apology for low performance ratings perceived that their ratings were more fair than those who did not receive an apology.

Development of Hypotheses

Greenberg's (1990) review of explanations stated that all three types had been shown to be effective; however, we do not expect all types of explanations to be equally effective in our customer complaint context. Since complainants have taken the time to write to a company, they believe that the company is responsible for the problem—they have already "named" the problem and "blamed" the company. Thus, explanations in which the company does not accept responsibility for the problem, such as excuses, are likely to be poorly received. This idea is consistent with work by Sutton, and Callahan (1987), who noted that managements' denials of responsibility for bankruptcy are not likely to be effective because their audiences expect them to be in control of their organizations.

Unlike excuses, which represent external accounts, apologies and justifications are examples of internal accounts (Crant & Bateman, 1993). From an attribution theory perspective, internal accounts are explanations in which a company accepts responsibility for the problem or event in question (the locus of causality is internal rather than external). In short, internal accounts suggest that the problem was something that should have been under the company's control. Such acknowledgments are likely what the complainant is expecting to receive from the company. This hypothesis is consistent with Elsbach's (1994) study of the cattle industry, which noted that organizations that respond to unfavorable events with "accommodative signals" (which include accepting responsibility for the events) are viewed more favorably by external audiences than organizations that respond with "defensive signals" (which include denials of the organization's responsibility). As both justifications and apologies accept responsibility for problems, we expected them to be received more favorably than excuses.

Previous research suggests that elements of fair procedures are related to a variety of organizational attitudes, such as commitment to the leaders and institutions who use the procedures (e.g., Tyler, 1990). We extended this work by examining how explanations influence customers' intentions to purchase a product in the future and their willingness to interact in the future with the manufacturer. We believe our context provides an interesting test of these relationships. Past field research on organizational justice issues has typically used employees as their target population. However, customers are likely to have less allegiance or commitment to product manufacturers than do employees as customers are not members of the organization and their interactions with the manufacturer are infrequent and brief. Thus, the relationships identified in the literature between procedural fairness and evaluations of authorities or organizations may not exist in our context. As companies rely on their customers for brand loyalty and support, discovering aspects of the customer complaint process that enhance customer satisfaction and commitment is an important topic. We expected that customers who receive explanations in which a company accepts responsibility for a problem will be more willing to do business with the company in the future than will customers who receive other types of explanations.

> *Hypothesis 1: Explanations in which a company accepts responsibility for a problem (justifications and apologies) will produce (a) greater complainant satisfaction with the explanations and (b) greater willingness to do business with the company in the future than explanations in which the company does not accept responsibility (excuses).*

Of course, the explanation provided in a reply to a complainant is not the only means by which an organization attempts to retain or regain the favor of its customers. Another popular strategy companies use involves providing coupons or inexpensive "goodies" in their return letters. Often the dollar value of the coupons outweighs the cost of the product complained about, particularly when it was inexpensive. However, an organization is likely to view such an investment in its relationship with a past and potentially future customer as worth the effort. Compensation may also further symbolic goals, such as demonstrating the importance of the customer to the company and the sincerity of the remorse the company feels for having inconvenienced the customer.

Perhaps the literature most relevant to generating predictions about the receipt of compensation is that on positive affect (e.g., Isen & Baron, 1991). Research in this area has demonstrated how relatively inexpensive items, including coupons, can affect a number of aspects of social behavior. Of most relevance to our research are studies showing how positive affect can reduce feelings of aggression and lead to more favorable evaluations of others in conflict contexts (e.g., Baron & Ball, 1974; Carnevale & Isen, 1986). Some of this research has even examined reactions to consumer products as a dependent variable. Isen, Shalker, Clark, and Karp (1978) investigated the judgments shoppers made about some of their major purchases: Those who had received a free sample from an apparently unconnected source just prior to making product evaluations reported more favorable evaluations of household products than did respondents who had not received the free samples. These studies suggest that receiving coupons will positively influence complainant reactions to the complaint process and lead to more positive attitudes toward a company.

> *Hypothesis 2: Complainants who receive coupons or other forms of compensation along with a company's reply letter will be more satisfied with the company's explanation and*

> *more willing to do business with the company in the future than those who do not receive such compensation.*

Studies of the efficacy of explanations have focused on a variety of different organizational events. These results have been somewhat inconsistent. Some studies (e.g., Bies & Shapiro, 1987; Greenberg, 1990) have found explanations to be helpful in gaining worker acceptance of bad news or negative outcomes; others (e.g., Konovsky & Folger, 1991) have found explanations to be of no use in enhancing perceptions of justice. Shapiro and colleagues (1994) argued that these results suggest that *problem severity* is likely to mitigate the power of explanations to satisfy complainants' needs for redress. For example, in the study that found explanations to be ineffective (Konovsky & Folger, 1991), the outcome or problem to be endured by the respondents was a job layoff—obviously an extremely negative outcome. This negative outcome can be seen as more severe that those explained in the other studies, which included temporary pay cuts and denied requests for additional resources (e.g., Greenberg, 1990). In a scenario-based study, Shapiro and colleagues (1994) found that negative outcomes with more severe implications (e.g., receiving a failing grade in a course required for graduation) led to beliefs that the explanation provided for the grade was less adequate than the identical outcome with less severe implications (receiving an "F" in an elective course that would not impede graduation).

We examined the issue of problem severity in two different ways. Because complainants in our study wrote letters to companies regarding a variety of products and problems, the complaints differ in terms of both the *price* of the product and the level of *dissatisfaction* the problem generated. Both of these concepts can be seen as surrogate measures of problem severity. Although we recognized that an inexpensive product could generate a severe problem—as in the case of the tragic outcomes of the poisoning of Tylenol capsules—we expected that, with level of dissatisfaction held constant, the strength of negative reactions would increase with the cost of a product.

> *Hypothesis 3: Product cost and customer dissatisfaction level will be negatively related to (a) belief that the explanation for a problem with the product is satisfactory and (b) intentions to do business with the company in the future.*

The final conceptual variable we expected to affect the efficacy of explanations is the speed with which complainants receive their replies. Research on justice has shown that the timeliness with which decisions are reached influences perceptions of fairness (e.g., Conlon & Fasolo, 1990; Lewicki & Sheppard, 1985). An assumption drawn from the dispute resolution literature is that people prefer prompt resolutions, as long as the speed of resolution is not thought to have negatively affected the opportunity to explain their case (e.g., Conlon & Fasolo, 1990). In the present context, complainants expected a prompt reply from corporations and may have perceived tardy responses as evidence of guilt or stalling. However, it may sometimes be in an organization's best interest to delay responding, as the problem in question may require investigation. Nevertheless, we expected complainants to respond favorably to prompt replies from corporations.

> *Hypothesis 4: A company's fast response to customers' complaints will be positively related to both their satisfaction with the explanation and willingness to do future business with the company.*

METHODS

Undergraduate business students in a management and organizational behavior class could satisfy a class requirement in several ways. One option available to those who had experienced dissatisfaction with a product they had purchased during the semester was to write a letter of complaint to the company. Students (N = 143) wrote their own complaint letters and were told to record the dates they mailed their complaints and the dates of the replies. The students chose 49 different products. A total of 121 company replies were received, for an organizational response rate of 85 percent. The dates of the companies' reply letters revealed that response turnarounds ranged from 2 to 80 days, with the average response taking about 19 days.

Upon receiving replies, students brought them to the attention of the class instructor, who gave them a short questionnaire to complete concerning their reactions. The questionnaire requested information about the product and the date the complaint was mailed. Next, the students answered a number of subjective measures using seven-point semantic differential scales. Finally, they were asked whether they received any coupons or other compensation and the dollar value of that compensation. Students were then instructed to attach the company reply letter to the questionnaire and return it to the instructor.

Independent Variables

Type of explanation. One of the authors and an assistant independently coded each company reply using the definitions provided by Greenberg (1990). From an initial examination of the letters, it became evident that the initial tripartite categorization of explanation types needed expansion. Six categories were eventually needed to code the responses. These categories and the number of company responses of each type were: (1) apology, 27 replies; (2) excuse, 12 replies; (3) justification, 16 replies; (4) both apology and justification, 29 replies; (5) avoiding or ignoring the complaint (labeled "avoid issue"), 23 replies; and (6) requests that the product be returned for evaluation by the company, 14 replies. With this classification scheme, interrater agreement was high (106 of 121 cases, or 88 percent); the two raters resolved differences in categorization by discussion.

Presence/absence of coupons. The students indicated whether they had received any compensation from the company; compensation was usually in the form of coupons, though in rare instances a company sent a check for the purchase price of the product.

Dependent Variables

We constructed a scale assessing satisfaction with a company's explanation from six questions that measured (1) complainants' satisfaction with the reply received, (2) the written explanation provided, and (3) how their complaints were handled as well as (4) their beliefs that they were treated fairly by the company, (5) beliefs that the company was interested in hearing complaints from its customers, and (6) the degree to which the company addressed the complainants' dissatisfaction with the product (Cronbach's $\alpha = .94$). A scale that measured the likelihood of complainants' doing future business with a company was constructed from two items: willingness to do more business with the company in the future, and the likelihood of their purchasing the product in the future (Cronbach's $\alpha = .88$). A final scale measuring satisfaction with the information provided was constructed from two items assessing (1) complainants' satisfaction with the information the company provided to facilitate customer comments and (2) the ease with which they could find the information needed to complain about the product (Cronbach's $\alpha = .84$). In addition to these three scales, there were two single-item measures, one on satisfaction with the speed of the company's reply and the other on level of dissatisfaction with the product complained about.

Several other descriptive measures were also constructed. We measured the number of days it took the company to respond by counting the number of days between the date a student mailed a letter and the return date on the letter from the company. The length of a company's response letter was measured as the number of words in its body. The price of the product was also recorded, and the results reported below reflect logarithmic transformations of product price. Finally, we also calculated the dollar value of the coupons or compensation provided to the complainant. Means, standard deviations, and correlations appear in Table 1.

RESULTS

A multivariate analysis of variance (MANOVA) was used to test for main and interaction effects among the study measures. The analysis revealed only main effects for both the explanation provided by the company (Wilks's lambda = .39, multivariate $F = 2.07$, $p < .001$), and for the presence or absence of coupons (Wilks's lambda = .64, multivariate $F = 5.48$, $p < .001$). Subsequent analyses reported below focus on these main effects only.

Table 2 presents the cell means for all of the dependent measures by explanation type. In general, the table reveals that receiving combined justification and apology replies, and justification, apology, and need-more-information replies produced more favorable reactions than did receiving excuses or avoid-the-issue letters.

Our first hypothesis predicts that complainants will express greater satisfaction with an explanation and report being likely to do future business with the company when the company explanation assumes responsibility for the problem than when it does not. We tested this hypothesis with two

TABLE 1
Descriptive Statistics[a]

Measure	Mean	s.d.	1	2	3	4	5	6	7	8
1. Dissatisfaction with product	3.70	1.92								
2. Satisfaction with information provided	5.76	1.19	−.23							
3. Satisfaction with speed of company reply	4.76	1.83	−.09	.37						
4. Number of days to reply	18.59	12.93	.05	−.09	−.51					
5. Satisfaction with explanation	4.80	1.66	−.05	.25	.42	−.23				
6. Likely to do future business with company	4.91	1.56	−.23	.29	.39	−.18	.82			
7. Product price[b]	6.12	2.18	.18	−.09	−.04	−.01	−.36	−.43		
8. Value of coupons[b]	255.70	642.54	−.02	−.06	.18	−.10	.27	.26	.06	
9. Length of reply letter[b]	123.77	63.62	.10	.00	.03	−.03	.18	.16	−.23	.07

[a] Numbers are based on 121 observations. Correlations greater than .16 are significant at $p < .05$ or greater.

[b] Product price value is a logarithm; value of coupons is in cents; reply length is number of words.

TABLE 2
Main Effects as a Function of Type of Explanation[a]

Measure	Apology	Justification	Excuse	Avoid Issue	Apology and Justification	Need More Information	F
Dissatisfaction with product	4.52_a	3.38_{ab}	3.17_{ab}	2.87_b	3.86_{ab}	4.00_{ab}	2.36*
Satisfaction with information provided	5.80	5.59	5.33	6.04	5.93	5.39	1.02
Satisfaction with speed of reply	4.78	4.88	3.75	4.65	5.17	4.79	1.06
Number of days to reply	22.70	18.19	20.50	17.65	16.41	15.50	0.95
Satisfaction with explanation	5.01_a	5.21_a	3.46_b	3.64_b	5.63_a	5.26_a	7.29***
Likely to do future business with company	4.94	5.41	4.08	4.26	5.43	5.00	2.60*
Product price	7.23_a	5.18_b	5.64_{ab}	6.51_{ab}	5.11_b	6.86_{ab}	4.35***
Value of coupons	398.59	243.75	88.25	88.65	193.76	540.07	1.36
Length of reply letter	90.00_c	176.25_a	160.92_{ab}	85.52_c	146.83_{ab}	112.14_b	9.54***

[a] Means in the same row with different subscripts differ significantly at $p < .05$ in Newman-Keuls simultaneous comparisons. F-tests are based on (5, 115) degrees of freedom.

* $p < .05$

*** $p < .001$

planned comparisons. Our first contrast compared apologies and justifications to excuses. For the measures of both satisfaction with the explanation and the likelihood of doing future business with the company, the contrast was significant in the predicted direction (t_{115} = 3.40 and 2.19, $p < .001$ and .05, respectively, for each measure). Our second contrast compared apologies, justifications, combined apology and justification, and need-more-information replies to excuses and avoid-the-issue responses. These comparisons were also significant (t_{115} = 5.55 and 3.20, $p < .001$ and .01, respectively, for the explanation satisfactory and do-more-business measures). Thus, both contrasts support our first hypothesis.

Table 3 shows findings on effects of complainants' receiving coupons or gifts. Coupons or other compensation greatly improved complainant reactions. As our second hypothesis predicts, receiving coupons resulted in greater satisfaction with the explanation and more willingness to do business with the company in the future. However, we also note from Table 3 that coupons tended to be distributed for less expensive products.

Our third and fourth hypotheses concern whether problem severity (measured by the price of the product complained about and reported level of dissatisfaction with the product) or the speed of the company's reply (measured both objectively and perceptually) influenced satisfaction with the explanation and the likelihood of future business with the company. Using regression analysis, we simultaneously entered these four predictor variables to determine their influence on each of the dependent measures. Results appear in Table 4. As can be seen, both regressions are significant. For the satisfaction-with-explanation variable, both product price and satisfaction with the speed of the reply were significant. For the future business scale,

TABLE 3
Effects of Coupons and Gifts[a]

Measure	No Coupons	Coupons	F (1, 119)
Dissatisfaction with product	3.79	3.66	0.12
Satisfaction with information provided	5.50	5.89	3.01
Satisfaction with speed of reply	4.38	4.96	2.81
Number of days to reply	19.62	18.04	0.41
Satisfaction with explanation	3.80	5.33	28.89***
Likely to do future business with company	3.96	5.42	29.22***
Product price	7.82	5.21	58.09***
Value of coupons	0.00	391.65	11.04***
Length of reply letter	106.93	132.72	4.64*

[a] Cell means are based on 42 respondents who did not receive coupons and 79 who did; F's are univariate.

* $p < .05$

*** $p < .001$

TABLE 4
Regression Analysis Results

Variable	Satisfaction with Explanation β	Satisfaction with Explanation F	Likelihood of Future Business with Company β	Likelihood of Future Business with Company F
Product price	−.360	20.85***	−.390	25.81***
Number of days to reply	−.039	0.18	.007	0.01
Dissatisfaction with product	.054	0.47	−.127	2.73
Satisfaction with speed of reply	.395	19.09***	.369	17.47***
Overall multiple R	.55		.58	
Adjusted R^2	.28		.32	
Overall F	12.70***		14.85***	
df	4,116		4,116	

*** $p < .001$

the same two variables are significant. Examination of the beta weights provides more specific evidence to support Hypotheses 3 and 4. In each regression equation, product price is (as predicted) negatively related to the dependent variable, and satisfaction with the speed of reply is positively related. Thus, measures of problem severity (product price) and the speed of company reply (the perceptual measure) influence satisfaction with the explanation and willingness to do future business with the company and account for between one-quarter and one-third of the variance in these measures.

DISCUSSION

Prior research on explanations in corporate annual reports suggests that managements typically assume responsibility for good performance (using justifications) but blame their environment (using excuses) for poor performance (e.g., Salancik & Meindl, 1984). These contexts differ from ours, however, in that we investigated company responses to specific individual inquiries in situations of poor performance only. Salancik (1979) characterized outside inquiries that lead to corporate responses as a "field stimulation" methodology. The results from our field stimulation argue for the widespread use of explanations in which a company assumes responsibility—which include justifications, apologies, and requests for more information and/or the return of the defective product—along with compensation. In addition, it is important to give customers timely feedback about their complaints, as elapsed time works to make a satisfying explanation less so.

Many companies responded to customers with multiple explanations. In fact, the most frequent corporate response combined apology with justification. Complainants received these combined explanations quite favorably: their ratings do not differ from those in the pure justification or apology conditions. This suggests that a company strategy that combines (1) the humility of an apology, (2) the assertiveness of a justification, and (3) the acceptance of responsibility (inherent in both) will provide very favorable outcomes, including customers' satisfaction with the explanations and their continued brand and company loyalty.

The notion of providing multiple explanations may have important implications for the justice and impression management literatures. As long as the multiple accounts an organization provides in its reply are seen as legitimate, such responses may have advantages over replies carrying a single explanation because they can appease a greater number of people. It may be that complainants selectively perceive the information present in an account, focusing only on whatever confirms their beliefs. Of the students in our sample who received a combined apology and justification, those seeking an apology received and perceived one and perhaps paid less attention to any justificatory information in the reply. Complainants seeking more detail or understanding may have attended to the information in the justification while ignoring the apology. Ultimately, both were satisfied. This might be seen as a natural outgrowth of research suggesting that people tend to search for confirming rather than disconfirming information.

It is also interesting to note that there were no cases in which internal and external accounts were combined in a company response (e.g., no replies containing both justifications and excuses). It may be that organizations realize that complainants may see multiple accounts that leave the locus of problem causality ambiguous as contradictory or inappropriate. Nevertheless, the utility of these types of multiple explanations is an empirical question, and perhaps future research will examine their efficacy. Whatever account or accounts are given, care must be taken to insure that explanations remain believable and sincere (Shapiro et al., 1994).

Our finding that responses that avoid the issue are perceived quite negatively is consistent with work by Elsbach (1994), which demonstrated the importance of acknowledging that there is a problem. Responses in the avoid-the-issue category did not acknowledge the problem, and some were form letters that did not even attempt to address the specifics inherent in the complaint. Thus, it is not surprising that explanations in this category led to less favorable complainant reactions. As the complainants in our study chose which events to complain about, they may also have chosen problems they were *certain* were the fault of the manufacturer, not the retailer. This focus might have led these respondents to be very skeptical of explanations in which a company tried to shift blame onto another party. Thus, examining the role of causal ambiguity in the assignment of blame would seem to be an obvious arena for future study.

Receiving coupons also enhanced satisfaction with explanations and willingness to do business with the company in the future. The results are consistent with a large body of experimental evidence linking positive affect to favorable evaluations of a variety of stimuli, including consumer products (e.g., Isen et al., 1978). The patterns are also consistent with results of conflict management research linking more favorable outcomes to enhanced ratings of both procedures and decision makers (e.g., Conlon & Fasolo, 1990). However, it is possible that asking respondents whether they received coupons cued those who did not receive them to be more dissatisfied than they were before they were aware of this issue (though we asked about coupons at the end of the questionnaire in an effort to minimize this possibility).

It was somewhat surprising to note that as products became more expensive, companies typically stopped offering compensation. Our results, as well as the results of Isen and colleagues (1978), suggest that companies may wish to rethink this strategy. It may be too costly for the makers of expensive items to completely reimburse a customer who complains, but a small amount of compensation may be sufficient to restore a positive attitude about the company and enhance the likelihood of future purchases.

Regarding problem severity, our regression analyses showed product price to be negatively related to both satisfaction with the explanation and future intentions to do business with the company. Our other measure of problem severity, perceived level of dissatisfaction, was not an important moderator in this context. Explanations for problems with expensive products are not as likely to be satisfying as explanations about less expensive products. Thus, product price appears to represent a boundary condition that limits the efficacy of explanations. As we mentioned above, one company strategy that may help overcome this problem is providing compensation for more expensive products that have problems. For example, Audi addressed an acceleration problem in some of its car models by offering a guaranteed trade-in value on the purchase of new cars.

Regarding the speed of replies, our findings suggest that companies also benefit from promptness. However, we hesitate to argue too strongly about the importance of this variable as common method variance is undoubtedly responsible for some of the strength of the relationship. The results would have been more convincing had the number-of-days measure been found to be an important determinant of satisfaction or future intentions. Additional studies using multiple methods would give us greater confidence in asserting a relationship between the speed of a company's reply and reactions to the explanation and the company.

The justice literature has demonstrated how satisfaction with procedures can enhance the judgments people make about their leaders, managers, organizations, and governments (e.g., Tyler, 1990). Our study extends the link between justice and institutions to situations in which the link between an individual and an organization is likely to be weaker and more sporadic. Our respondents did not work for the companies they were evaluating; they merely interacted with them when they purchased their products. Yet, in spite of this relatively weak relationship, we see that different types of explanations lead to different levels of satisfaction and that variables found to affect justice judgments in other contexts, such as problem severity and speed of resolution, played a role. Thus, it may be fruitful to apply justice theories that assume a strong group identity, such as the group-value model (Lind & Tyler, 1988), to environments without strong person-organization ties, such as customer relations.

The strength of our study is that we were able to analyze actual corporate responses and measure the reactions of people who experienced real problems with products they purchased. Although the results clearly show that extending a justice perspective to the customer complaint process can be valuable, several limitations warrant mention. First, the quasi-experimental nature of the study resulted in independent variables that were measured rather than manipulated, thus reducing our ability to claim causality. A second limitation is that the letters written by the complainants and the replies from the companies varied in form and content. A valuable future study would be one in which complaints and corporate responses were more carefully controlled (perhaps a scenario-based study).

A third limitation of our study concerns the sample itself. Our research interests cued many people who would not normally have voiced complaints to write letters complaining about product problems. Thus, our sample may not represent typical "unstimulated" complainants. For example, it may be that our respondents were more easily satisfied with corporate responses than a comparison group of customers who wrote complaints completely of their own volition would be. With regard to our data, perhaps our perceptual measure of dissatisfaction would have had more influence on judgments of the explanation and future intentions toward the company in a more representative sample. Both researchers and organizations may want to frame our conclusions as optimistic—in another sample, justification and apologies may not work as well in reducing negative attitudes about a product and a manufacturer.

The limitations of our study suggest an ambitious agenda for future research. In addition to examining the role of causal ambiguity, researchers might also examine whether the manner in which an explanation is conveyed (verbally or in writing) plays a role in explanations acceptability. The media richness of a phone call or an in-person exchange may enhance the ability of explanations to mitigate feelings of dissatisfaction. Explanations may enhance evaluations of an organization in other contexts. These settings might include the management of merchandise returns in retail stores, problems with food or service in a restaurant, and the "damage control" an organization engages in when confronted with a crisis. One might classify Intel's initial handling of the Pentium processor crisis as an avoid-the-issue response, followed (after the firm had received strong criticism) by an apology. As customers in a recent survey (*Marketing News,* 1995) ranked "how companies handle complaints" as the second most important factor they considered when making purchase decisions (quality was ranked first), furthering understanding of the complaint process and customer reactions would seem to be an area in which further research will pay dividends for both customers and organizations.

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It is perhaps because of this difficulty that the contents of this ethos are only seldom explicitly detailed (and less rarely elaborated in print). Thus, the purpose of the proposed forum is to explore the sociology of management as a science, with a focus on the ways in which scientific research and the diffusion of scientific knowledge within the management profession are influenced by its disciplinary paradigm. Preferred submissions will be those that address the management discipline as a scientific activity rather than as the study and application of concepts and theories.

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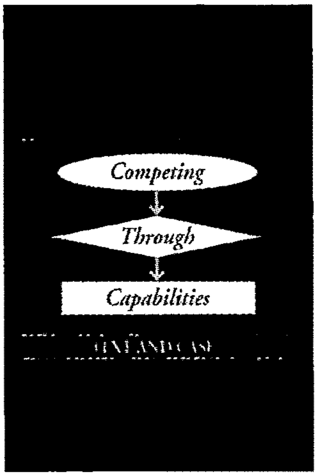

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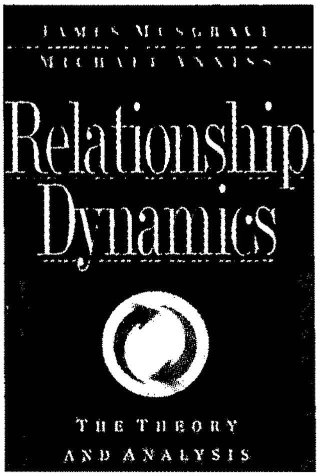

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COMMUNITY, POPULATION, AND ORGANIZATION EFFECTS ON INNOVATION: A MULTILEVEL PERSPECTIVE

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Two distinct themes emerge from the Special Research Forum on Innovation and Organizations. One group of articles develops an expanded view of the influence of context on organizations' ability to innovate. Together, the articles offer a complex multilevel view of context as including elements ranging from the dominant strategy of an organization to the social-psychological antecedents of creativity. A second group of articles provides a community and population perspective on the diffusion of innovations. We suggest the possibility of a union between the context and industry dynamics approaches.

As we contemplated editing this Special Research Forum on Innovation and Organizations, we observed that a plethora of books on innovation had been written in recent years. Our collections had grown dramatically during the 1990s as the topic took on increasing practical and theoretical significance. This vibrant literature covered topics and concepts ranging from paradigm shifts, through intrapreneurship, intelligent organizations, mastering change, and time-based competition. Most of these works were in good currency, enjoying unparalleled popularity among managers and enviable citation rates among scholars. Surely such a wealth of information signaled the arrival of a dominant theoretical model of innovation in organizations.

Whereas each book and article made its own valuable contribution, we were disappointed to discover that no dominant theoretical perspective had emerged to integrate the multiple streams of innovation research. Unlike other evolving fields of organizational inquiry, such as organizational economics, contingency theory, organizational ecology, and institutional theory, innovation research demonstrates little in the way of common theoretical underpinnings to guide its development. Although these other approaches are not free from internal debate, each has at its core conceptual principles and advocates that drive its theoretical and empirical development.

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The uncommon evolution of the study of innovation may be driven by a set of concerns shared collectively by its research community. However, more than other organization theory perspectives, the study of innovation appears to derive from practical rather than theoretical concerns. Innovation theory has been dominated by normative explanations of how to achieve an outcome seen as central to the interests of managers: increasing the number of innovations generated.

The theory used to explain these outcomes has changed little over 30 years. At its core, innovation theory is an adaptationist perspective guided by three basic assumptions: (1) innovation is universally desirable for organizations, (2) once an organization increases its size beyond a critical mass it becomes more inert, less capable of meaningful organizational change, and only haltingly proficient at innovation, and (3) certain structures and practices can overcome inertia and increase the generation rate of innovation. The study of innovation had become the study of surmounting bureaucratic obstacles using the practice du jour.

The articles in this special issue make at least two contributions to a more refined understanding of innovation phenomena and, in so doing, facilitate theory development. First, a set of four articles addressed the organizational context of innovation generation in a unique manner. Unlike previous research, which has concentrated on one or a few elements of organizational context, these articles present integrated, multilevel models based on variables ranging from creativity to strategic focus. For us, the integrated, systemic nature of this research is its greatest contribution.

Second, two novel articles move beyond the study of context and examine the dynamics of industry-level effects on innovation. Using models that specifically incorporate longitudinal databases into their research designs, their authors examine community- and population-level effects on innovation. They not only examine the rate of technological variation, but also introduce additional dependent variables, such as speed to market and the effect of innovation on performance.

Collectively, the articles in this special research forum suggested the need for additional theoretical integration to link organizational context with industry-level dynamics. In the following pages, we preview the contributions made here, suggest a model to integrate population, community, and organizational concerns in the study of innovation, and conclude with an agenda for future research.

THEME ONE: AN EXPANDED VIEW OF THE CONTEXT OF INNOVATION

A major area of inquiry in research on innovation and organizations has been the study of organizational contexts that impede or enhance the generation, adoption, and diffusion of innovation. The earliest and most influential writers in the field firmly established this theme. Burns and Stalker (1961) set the stage with their comparison of post–World War II electronics firms in Scotland and England and more established industrial enterprises. Their distinction between organic and mechanistic forms of organizing has endured as a conceptual framework to this day. Similarly, Lawrence and Lorsch's (1967) case studies showed that the structure of interdepartmental relationships was a significant influence on organizations' ability to produce new products. The works of Hage and Aiken (1967), Zaltman, Duncan, and Holbeck (1973), and others set the stage for a 30-year history of the study of how organizations produce innovation.

Research on the contextual factors that influence innovation has not abated. The late 1980s and early 1990s witnessed a renaissance of interest in how organizations, especially large ones, create innovative products and services. Kanter (1983) and Pinchot (1985) firmly established the role of the intrapreneur in moving innovations through large, complex bureaucracies. Burgelman's (1983) field study emphasized the role of autonomous strategic behavior in generating innovative ideas. Van de Ven and his associates created one of the largest programs studying the detailed context of the production of innovation (Van de Ven, 1986; Van de Ven, Angle, & Poole, 1989). Numerous other researchers have recently chronicled their multiyear studies of innovation, including Jelinek and Schoonhoven (1993) and Leonard-Barton (1995). The *Administrative Science Quarterly* (Tushman & Nelson, 1990), the *Strategic Management Journal* (Guth & Ginsburg, 1990) and now, the *Academy of Management Journal* have devoted special issues to the topic of innovation. It is clear that the study of the generation of innovation is central to the study of organizations and organization theory.

Although varied in content and method, most of this research has been constructed around two core assumptions. First, researchers have usually portrayed innovation as a universally useful and productive end in and of itself; they have typically not distinguished between types of innovations (see Daft and Becker [1978] for a notable exception) or examined the commercial success of innovations in the marketplace. Second, the contextual factors that have been examined are numerous but generally represent organization-level features that create contexts that can be considered as enabling or inhibiting innovation. The articles in this special forum on the organizational context of innovation expand the view of context significantly, examining factors that are not purely organizational in character.

The basis of a new multilevel model of context emerges. In these four articles, context ranges from the immediate psychological context that affects individual creativity, through organization-project interaction, to corporate strategy. What is particularly useful is that the articles examine the connections between these levels of analysis. Each study nicely links, within itself, one or more levels, and readers can extend these linkages across articles. The combined effect is a more soundly integrated and expanded view of the factors leading to innovation.

The article by Hitt, Hoskisson, Johnson, and Moesel "The Market for Corporate Control and Firm Innovation," provides detail on a heretofore underexamined area of innovation context—corporate strategy. Hitt and colleagues maintain that mergers, acquisitions, and divestitures are a major component of the strategies of large firms and that firms that are active in the market for corporate control create, perhaps unwittingly, contexts inside their organizations that are detrimental to internally generated innovation. In essence, the authors maintain that mergers, acquisitions, and divestitures are strategic choices that compete against firm innovation. Such competition has an impact on two organizational properties; managerial attention, and resources. Senior managers understandably devote considerable energy to merger- and divestiture-related activities and correspondingly underinvest time in managing innovation. Acquisitions and divestitures also consume slack resources that would otherwise be available to generate internal innovation. A shortage of both managerial attention and resources causes organizational innovation to fall as acquisition and divestiture intensity rises. A further contribution of Hitt and colleagues' article is that it provides an integrative model that links corporate strategy to the actual behaviors of senior managers. These authors postulate and find support for the notion that the more senior managers engage in acquisition and divestiture, the more they use financial controls instead of strategic controls to manage business units. The emphasis on financial controls tends to drive out internal innovation and fosters a short time horizon.

The article by Nohria and Gulati, "Is Slack Good or Bad for Innovation?" further investigates how resources promote innovation. The authors' argue that there is an inverse U-shaped relationship between the degree of slack available to organizational subunits and the extent of innovation these units produce. Their review of the literature on slack revealed two opposing perspectives: slack is essential for innovation, and slack leads to wasteful, undirected behavior. The argument for slack is well known to innovation researchers: slack allows for experimentation, provides resources to meet environmental uncertainty, promotes chance discovery, and frees managerial attention to support innovation. The argument against slack is perhaps less familiar but equally compelling. Nohria and Gulati point out potential agency theory problems. Slack can lead to promotion of pet projects and to waste and inefficiency; in the face of abundance, managers are likely to be unfocused and undisciplined and to approve projects that add little to the value of their organizations. Nohria and Gulati argue that both perspectives are valid to a point and propose an inverted U-shaped relationship between slack and innovation as a resolution of the apparent contradictions between them. Up to what the authors call an inflection point, increasing levels of slack promote increases in the level of innovation. However, beyond that inflection point the negative effects of slack set in and innovation actually decreases. They find support for their hypothesis in data collected from two multinational companies. A compelling part of their methods is that they measure innovation not only as the number of innovations a unit produces, but also as the economic benefits that accrue from the innovation. Their results provide significant support for their hypothesis.

The article by Dougherty and Hardy, "Sustained Product Innovation in Large, Mature Organizations: Overcoming Innovation-to-Organization Problems," examines multilevel contextual effects on innovation in a sample of 15 large, mature organizations. Using a multiple case study approach, Dougherty and Hardy explored project-organization interactions in 40 new product development efforts spanning several years. Their aim was to determine if large organizations developed an ability to sustain innovation over a long period of time. Three generic innovation problems were found in their study: (1) resource flows and mechanisms to sustain resource flows were absent; (2) the organizations possessed little in the way of collaborative structures to develop innovations across functional departments; and (3) strategic support for innovations was absent—the data suggest that senior managers in the organizations studied either never supported the projects or did so only temporarily.

What is intriguing about Dougherty and Hardy's results is that they cast organizational problems, such as poor cross-functional interaction, as only one of three major problem types. Like Hitt and his coauthors and Nohria and Gulati, these researchers strongly emphasize problems with strategy and resources and claim that such obstacles to innovation are generated by managers who operate at the highest levels in their organizations. In particular, Dougherty and Hardy claim that senior managers, during the time period of their study, were preoccupied with downsizing and other cost-cutting efforts and paid little attention to innovation as a result. Innovation exists despite substantial contextual blocks and only because effective middle managers have developed techniques to successfully manage the project-organization interface.

The fourth article that deals with the context of innovation also examines multilevel effects. However, the dependent variable of interest is creativity rather than innovation. In "Assessing the Work Environment for Creativity," Amabile, Conti, Coon, Lazenby, and Herron devote their attention to the psychological context that promotes or inhibits individual creativity. To these authors creativity is a necessary but not significant condition for innovation. They argue that the study of innovation implies the study of creativity; for innovation to occur, a psychological context must exist that allows individuals to be creative. Creativity is the missing link between context and innovation as outcome.

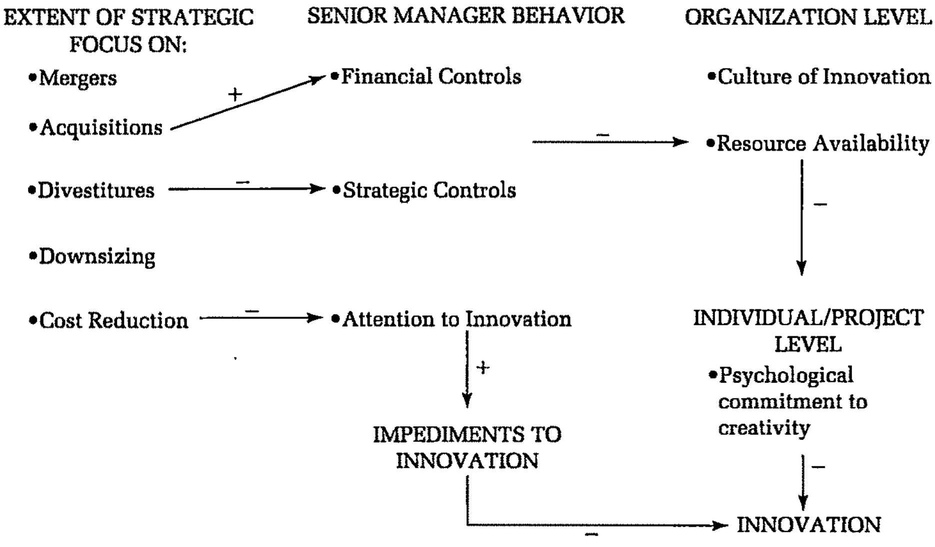
This study is unusual because it summarizes, both theoretically and methodologically, a long-term research program on creativity. Amabile and her colleagues propose a theoretical model of the multilevel constructs that enhance or inhibit individual-level creativity. They introduce and chronicle the development of the instrument, called KEYS, used to test this theory and then offer substantial support for both their theoretical model and the psychometric properties of the instrument. They identify encouragement for innovation at the organizational, supervisory, and work group levels of analysis, and individual autonomy, sufficient resources, and challenges in the work itself as supporting creativity. Workload pressures and organizational impediments are identified as inhibiting creativity. The model and associated instrument are validated in two separate studies of creative and noncreative projects.

Like the other articles, this study of creativity crosses levels of analysis. We see how contextual factors at multiple levels of analysis influence individuals to be creative and how their subsequent behaviors are also viewed as creative. The availability of an instrument for measuring these contextual elements should encourage innovation researchers to look at creativity as a dependent variable.

Each of these works stands on its own as an important contribution to the literature on how contextual factors affect the ability of an organization to generate innovation. Each presents a complex view of context. When we looked at the four articles together and the connections among them, we could see the largest potential ramifications for the study of the context of innovation. Figure 1 summarizes the factors identified in the four articles on context and their relationships. The four levels of analysis are interrelated to ultimately affect the amount of innovation an organization generates.

The literature on innovation in large, mature firms has generally granted that the needs of the ongoing enterprise will drive out new product and service innovation. This problem has typically been formulated as one of efficiency versus creativity. Pure creativity is cast as freedom from distraction, and the ongoing enterprise as the major distraction. The useful distinc-

FIGURE 1
A Multilevel Model of the Effects of Context on Innovation



tion that the special research forum authors bring to this theoretical formulation is to highlight a new form of distraction that impedes innovation. Several authors discuss corporate-wide strategic initiatives conducted on a large scale as the activities that absorb money and attention, rather than simply the management of current products.

Based on the findings of Hitt and colleagues and Dougherty and Hardy, the integrated model we propose places the strategic focus of an organization in a critical causal role in the innovation process. The five corporation-level strategic initiatives specifically mentioned by these authors are acquisitions, mergers, divestitures, downsizing, and cost reduction. These strategies are a result of a set of institutional forces that have shaped organizations from the mid 1980s through the early 1990s. Their adoption has had a direct effect on the behavior of senior executives. When faced with implementing any of these strategies, executives are likely to: (1) increase financial controls, (2) decrease strategic controls, and (3) reduce the time and attention they devote to innovation-related activities. Although the behavior of top management teams has been a topic of much interest to organizational scholars, little work has been done that links senior executives' behavior to the innovation process. This appears to be a fertile area for future innovation research.

Senior managers' behavior, in turn, has effects on organization-level factors that influence innovation. First, as Dougherty and Hardy point out, resources do not often flow smoothly to innovation. As senior managers' attention turns toward large-scale strategic endeavors, these endeavors are likely to absorb organizational slack, leaving little available for internal innovation. Adoption of one or more of the strategies in this model implies that an organization is purposefully restricting or redirecting its resources away from internal innovation.

The combined effects of strategy implementation and senior executive behavior may also overwhelm the culture of an organization and its ability to be creative. Organizational and supervisory encouragement for product and service innovation will not be possible; senior-level support is directed elsewhere, and a cascading effect is likely. An emphasis on financial control over strategic control will likely create an environment characterized by intense workload pressure. Those responsible for innovation will turn toward satisfying senior executives who neither support nor seek creativity. A focus on corporation-wide strategy affects organization-level variables, which in turn affect individual-level motivations to innovate. When a corporation's culture no longer supports innovation and when resources are no longer available, creativity will decline, causing innovation to decline. There are also likely to be direct effects of organizational impediments on innovation. As senior managers shift their own behavior to implement corporation-wide strategies, those reporting directly to them will likely engage in increased political behavior. This political behavior will result in heightened boundaries between divisions and functions and a reduction in cooperation.

Conceptualizing organizations as systems of relations is a significant contribution of this set of articles. Our hope is that they will stimulate scholars to examine multiple levels of analysis when researching the role of organizational context in innovation and, in particular, to develop links between corporate strategy, top management behavior, organization design, and the psychological antecedents of creativity as bases for innovation.

THEME TWO: COMMUNITIES AND POPULATIONS—A DYNAMIC VIEW OF INNOVATION

We have observed that historically, research on innovation has stemmed primarily from adaptionist theories of organization focused on the internal context of innovation. Seldom have multiyear, longitudinal, or dynamic research designs been harnessed to test assumptions about innovation's role in organizational adaptation. Despite the shift in the late 1970s to organizational theories that strongly emphasized the external, environmental context of organizations, among which Hannan and Freeman's (1977) population ecology and Meyer and Rowan's (1977) institutionalized environment theories are notable, research on the management of innovation has remained strongly focused on internal context.

Departing from this trajectory, the next two articles in this special research forum focus on the external environment of innovation. They also depart from the traditional approach to organizational innovation in other ways. Their authors have adopted a dynamic perspective, and the passage of time is explicitly incorporated into their research designs. For his study, "A Community-Level Analysis of Sources and Rates of Technological Variation in the Microprocessor Market," Wade collected data on all U.S. merchant producers of microprocessors over an 18-year period. In "Generational Technological Change: Effects of Innovation and Local Rivalry on Performance," Lawless and Anderson use data on the microcomputer industry over the period 1982–91 to analyze the effects of innovation and external market complexity on firm performance. Furthermore, these authors have shifted the level of analysis to include intercorporate events and communities of organizational actors in the external environment. Wade adopts a community-level framework to identify technological communities of firms that support (have a stake in) the microprocessors associated with a given design. Lawless and Anderson examine how rapid innovation creates a complex mosaic of relationships among firms. Finally, both pieces deal with what happens to an innovation once it is produced. In the articles on context in this forum, the predominant dependent variable is the creation of an innovation. In contrast, in this second group the creation of an innovation is the beginning of the inquiry. Together, these two articles provide complementary perspectives on the dynamics of innovation in the U.S. computer and microelectronics industries.

Lawless and Anderson studied innovation, complexity, and firm performance in the population of firms that manufactured microcomputers for sale in the United States between 1982 and 1991. The microcomputer market is an example of a high-velocity environment in which change is so rapid that it seems nearly continuous. In such environments, speed of managerial decision making and action are strategic imperatives (Eisenhardt, 1989; Gersick, 1994; Schoonhoven et al., 1990). The authors observe that punctuated equilibrium models capture discontinuities well but deal less well with the processes of incremental change between discontinuities. They argue that rapid innovation within an interval thought to be characterized by incremental change nonetheless creates complex competitive conditions and alters organizations' life chances.

Lawless and Anderson found that during periods of incremental technological change, market niches and competitive conditions of intense local rivalry were created in the microcomputer industry. Firms that differentiated themselves technologically within a niche and adopted technology quickly were rewarded with strong performance. Speed also played a part: the sooner a firm innovated, the better it performed. This is an important finding, because it links innovation speed and technological change to an organization's performance. So, rather than assuming that innovation in and of itself is desirable and that it enhances organizational performance, they find instead that the speed of innovation adoption enhances firm performance. In contrast, firms that changed niches incurred a penalty: their performance declined in the year following the niche change. This article makes an important contribution to the punctuated equilibrium model by refining understanding of the dynamics of accelerated, innovation-intensive markets. Periods of incremental change in accelerated markets, where innovation and change are rapid, create complex effects on interfirm rivalry and on individual-firm-level outcomes.

The article by Wade addresses the community-level origins of sources and rates of technological variation, a form of innovation, in the microprocessor market over an 18-year period. Adopting a population perspective, the author includes all 35 firms that produced microprocessors between 1971 and 1989, although some were new firms and others were existing semiconductor manufacturers that entered the developing microprocessor market.

Wade's goal was to identify the organizational and community-level processes governing the sources of technological variation in the microprocessor market and their rate of emergence over the period studies. He found that most new microprocessor designs were introduced by new firms, rather than incumbent organizations. This finding is important, because it adds evidence to the argument that small, new firms are the predominant sources of innovation in the U.S. economy. He also found that organizational ecology's density-dependence model predicts the rate at which "sponsors" of new microprocessor designs enter the market. The rate of sponsor entry into the microprocessor market increases as the density (number) of technological communities increases, declining when density reaches a high level and with the emergence of a community coalesced around a dominant design. Perhaps the most interesting finding, however, is that as market concentration increases, the entry rate of new firms also increases. But most of these new entrants created designs that were architectural innovations (Henderson & Clark, 1990). This latter finding suggests that the emergence of a dominant design leads to additional innovation, bringing new approaches and technologies in its wake.

A CHALLENGE TO STUDENTS OF INNOVATION: INTEGRATING CONTEXT AND INDUSTRY DYNAMICS

The two distinct themes that emerged from the work in the Special Research Forum on Innovation and Organizations are not new. A dichotomy between the study of innovation as context and innovation as an industry-level dynamic has been central to over 40 years of research. As evidence, consider the compendiums produced by Rogers and Shoemaker (1971) and Rogers (1983). Both volumes cite thousands of studies in the area of innovation in general and innovation in organizational settings in particular. The content of the 1983 volume is particularly revealing. Of the 11 chapters in the book, 4 deal with topics on context, specifically those factors that govern the intraorganizational generation or adoption of innovations, and 7 deal with the diffusion of innovation across organizational sites. Thus, we have a bifurcated literature. Again, there are two themes—the problem of generating innovations and the problem of what happens to innovations once they are produced. The two approaches are distinct and almost antithetical. Table 1 summarizes the major differences between the context approach to innovation research and the industry dynamics approach.

The main research question of the context approach is, What multilevel organizational factors predict the generation or adoption of an innovation? When posing this question, researchers typically study large, complex organizations, viewing them as multidimensional social systems. The assumption is that innovation is universally worthwhile, independent of its type or commercial success. Methods that fit this research question typically involve cross-sectional designs framed to predict the innovation level of an organization. Mohr (1982) would label this a variance theory approach to the study of innovation.

The primary research question of the industry dynamics approach is, What are the population effects on the production of innovations? Researchers using this approach are more concerned with what happens to specific innovations, or classes of innovations, and they see the innovations as events in time. The generating organizations typically assume the status of "black boxes" whose internal characteristics are not so important to the analysis (Strang & Tuma, 1993: 614). Because researchers are interested in what hap-

TABLE 1
Major Differences between the Context and Industry Dynamics Approaches to Innovation

Dimensions	Context Approach	Industry Dynamics Approach
Types of samples	Large, multi-industry; focus on generalizability Example: *Fortune* 500 firms	Small, typically comprising all or most firms in an industry Example: Semiconductor firms
Conceptualization of organizations	Complex systems	Black boxes
Conceptualization of innovations	Number of innovations produced	Innovations are events differing in success and diffusion rates
General approach to theory development	Variance theory	Process theory
Research methods	Cross-sectional designs; factors that predict innovativeness	Longitudinal, event-histories; population-level factors

pens to specific innovations, they typically study an entire industry over several years. Mohr (1982) would characterize this as a process approach to the development of innovation theory.

What the research community has not achieved through pursuing these two separate approaches to studying innovation is development of models that integrate innovation activities at the micro (organizational) level with macro processes that operate at a social level. Researchers who adopt the contextual approach treat all innovations as intellectually and practically equivalent, giving little regard to the influence of other organizations on a focal firm's innovation process. Researchers who study innovation solely as a diffusion phenomenon neglect the microlevel social structure that produces innovations or governs their adoption. It seems to us that these two perspectives can peacefully and productively coexist. The challenge is to create theoretical and methodological bridges between the two levels of analysis (Greve, 1995: 446).

To do so, researchers should consider all organizations as embedded in networks of other organizational actors that influence how and when they engage in innovative activities (Drazin & Rao, in press). This influence might take the form of competitor actions, social status, or strong ties to other firms (e.g., interlocking directorates, joint ventures, and so on). Factors like these, which might influence an organization's decisions about undertaking innovation, exist at the level of the social field, external to each organization.

Following Bateson (1979), we conceptualize the introduction of an innovation as the result of two embedded stochastic processes, one operating at the level of the organization, and the other operating at the level of the industry. We define a stochastic process as a set of events that contains a random component combined with a selection process that results in some events continuing to endure while others do not. At the organization level, contextual factors create a stochastic process in which proposed innovations go through a maze of tests that determine whether or not they are implemented. At the industry level, influences on organizations determine whether or not ideas are seen as viable and timely in the market. The internal selection process proposes ideas, and the external stochastic process disposes of those ideas (Bateson, 1979: 178).

Given a set of organizations operating in some industry-wide context, we would expect that two sets of factors would determine whether or not a particular organization launches an innovation. First would be a selection process, governed by internal, contextual attributes of an organization, that would allow ideas to move (or not) to the decision stage. Second would be a selection process, governed by the organization's position in a social network, that would determine whether or not the proposed idea was viable. For example, we could model the event of launching an innovation as a function of two sets of factors: a set related to attributes of the organization and a set related to its position in the network.

A Multilevel Model of Diffusion

Three collaborators, Strang, Tuma, and Greve, have introduced a new conceptual and methodological tool that offers the potential to simultaneously model organizational and network influences on innovation outcomes.[1] The model, itself an innovation in event-history analysis, is called the heterogeneous diffusion model. The statistical details of the modeling technique can be found in Greve, Strang, and Tuma (1995). To us, what is most important is the model's ability to resolve the theoretical problem of integrating contextual and diffusion approaches to innovation.

To date, the heterogeneous diffusion model has been used solely to study processes of innovation adoption. Strang and Tuma (1993) presented the basic conceptual and statistical model and then used it to reanalyze data from Coleman, Katz, and Menzel's (1966) pioneering study on the diffusion of tetracycline. Greve (1995, 1996) used the model in two studies to analyze patterns of adoption of music formats in the radio industry. In all three studies, significant effects for both adopter characteristics and industry influences were hypothesized and found. The heterogeneous diffusion model estimates several sets of parameters that predict a hazard rate from event-history data in which the event is the adoption of an innovation (below, we suggest other innovation activities that could be modeled using this approach). The model provides two general sets of parameter estimates. The first set models factors associated with characteristics of the innovation adopter, and the second set models contagion effects, or influences of past adopters on current adopters.

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[1] We are indebted to Hayagreeva Rao for pointing out the advantages of the heterogeneous diffusion model.

The first vector of parameters, *propensity,* includes all non-network forms of influence on the hazard rate. In the research published to date, the propensity vector consists of organization-level contextual factors that influence whether or not an innovation will be adopted. The study of propensity variables alone parallels traditional studies of adopter characteristics (see the review by Damanpour [1991]). To this point, the model is consistent with most studies of innovation, even though it is based on event-history methods.

The second vector of parameters in the heterogeneous diffusion model includes three types of contagion effects. The first effect is the *susceptibility* of focal organizations that have not yet adopted an innovation to influence from previous adopters. Susceptibility is modeled as characteristics of the organizations at risk of adoption, in much the same way as propensity is modeled. Susceptibility, however, refers to the openness of the focal organization to influence by other agents. The second contagion effect, *infectiousness,* refers to the properties of "spreaders," previous adopters that influence potential adopters. The final contagion effect, *proximity,* measures the similarity of a potential adopter organization to previous adopters. Proximity can be modeled geographically, by traits of organizations, or by researcher-supplied patterns of network links.

Although the heterogeneous diffusion model has been used to date only in the context of adoption, we believe it could have utility for modeling other types of innovation activities, such as innovation generation. The major advantage of this model is that it allows the simultaneous modeling of contagion effects at the industry or population level of analysis and organization-level contextual factors that could influence innovation generation.

To motivate this possible use of the heterogeneous diffusion model, let us consider an empirical research question: What leads an organization to *introduce* an innovation designed to compete in a particular industry? The innovation might be a new semiconductor device, a bioengineered drug for treating a disease, or a new investment instrument such as a unique financial derivative. The decision to place the innovation in the market is ultimately the responsibility of decision makers inside the organization. But what influences are these decision makers subject to? First would be a host of internal organizational factors that we have labeled contextual. Such influences might include management's attention to the strategic need to innovate and the organization's ability to fund the innovation—essentially, factors introduced by our first set of authors. But decision makers would also be influenced by factors external to their organizations, factors at the industry level that are usually considered as diffusion, or contagion, effects. Certain to influence a given organization in its decision to innovate or not would be actions taken by its competitors. Innovation is not an isolated activity, but one taken in the context of peer organizations.

DISCUSSION AND DIRECTIONS FOR FUTURE RESEARCH

The role of organizations in the generation of innovation continues to be a topic of broad theoretical and practical concern. As several authors have argued (e.g., Jelinek & Schoonhoven, 1993: 2; Leonard-Barton, 1995), adaptation and innovation are among the essential competitive and organizational challenges facing domestic and international firms today. The recent spate of trade books on innovation testifies to the growing demand from managers for knowledge on how to manage their organizations to meet the challenge of an apparently unrelenting need to innovate.

A major purpose in undertaking this special research forum was to promote rigorous research addressing these issues. The articles that follow achieve this objective in two critical areas: (1) they promote a more complex view of the organizational context of innovation and (2) they chronicle industry- and population-level effects on both the generation and adoption of innovations. Seeing these two contributions side by side resulted in our articulating a challenge for innovation researchers to integrate research on context and research on industry dynamics. We proposed that one avenue for accomplishing this goal is the heterogeneous diffusion model recently developed by Greve, Strang, and Tuma. After absorbing the work in this special issue, we encourage readers to gain exposure to this model and use it as a departure point for building multilevel models of innovation diffusion and generation.

While preparing this introductory article to the special research forum, we reexamined the call for papers to assess the research that remains before us. Beyond the need to theoretically integrate community, population, and organization effects on innovation, much work still remains. From this examination, several areas emerged that we believe offer meaningful opportunities for research and theory development on the relationship between innovation and organizations.

In the call for papers, we asked if competitive pressures to compress product development cycle times have altered the organization of innovation in any fundamental way. The flurry of mergers, acquisitions, joint ventures, and strategic alliances that occurred during the 1980s and early 1990s suggests that contemporary organizations have experimented with alternative forms of organizing for innovation (and other strategic needs). The research challenge remaining is to rigorously specify alternative forms of organizing and to compare the effects of these alternatives on innovation dynamics at the community, population, and organization levels. We still understand less than we should about how interorganizational relations and networks influence innovation. For example, it would be helpful to understand theoretically whether consortia, alliances, and joint ventures influence rates of innovation, and at what levels of analyses they do so.

Similarly, how does the institutional environment (for example, federal policies on collaboration and antitrust enforcement or on the regulation of specific industries, such as telecommunications) influence the innovation-related behavior of existing organizations, the founding rate of new firms, and the emergence of new industries? Whereas the research domain of institutional theorists has primarily been not-for-profit and social service organizations, notions from institutional theories can usefully be brought to bear on problems of innovation in for-profit, manufacturing, and technology-intensive organizations and industries. One of the leading institutional theorists, Scott, has concluded that both technical and institutional processes have given rise to new organizations and organizational forms and are likely to continue to do so. "New technologies are constantly being created and institutional forms that were once strong—such as religion—or the newspaper industry—are no longer as robust" (Scott, 1992: 166). Similarly, other institutional forms, such as organizations engaged in mass communication and television programming, have become formidable contemporary forces. Therefore, both institutional and technical forces appear to be vigorous influences on contemporary organizational behavior, including innovation. Theories of innovation ought to specify the nature of these dual influences.

In an influential work on the generalizability of theories of organization, Boyacigiller and Adler (1991) concluded that organization science in the United States is a "parochial dinosaur." Because empirical research in the organization sciences has focused on North American organizations, mostly U.S. ones, those authors have called into question the generalizability of current theories to firms not in North America and to firms imbedded in cultures not derived from an Anglo-Saxon heritage. The authors make a cogent argument as to why such theories of organization may have limited scope of application. With the increasing commerce between U.S. and Asian organizations and the extensive social and economic changes in process as a result of the collapse of the Soviet Union, demand for management consultants from the United States has increased. A parallel increase in the demand for U.S. business school professors to help found business schools in these international locations has also been intense. The so-called internalization of business and the establishment of a "world economy" present rich opportunities for research and intellectual exchange. Until theories of organization and innovation are empirically tested in political systems and cultures beyond North America, U.S. researchers will have little confidence that the models imported by U.S. business schools and management consultants who are their graduates will have similar results or consistent efficaciousness in these modified contexts. Similarly, insights drawn from research and management practices in international settings should be valuable for revising and refining theories of organization and industrial behavior as they apply to problems of innovation.

In addition to being susceptible to charges of ethnocentrism, current theories of innovation may also be industry-centric. We think it is fair to

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characterize most organizational research on innovation as dealing with samples or populations of industrial organizations, where, by and large, innovation is defined as development of a new product or process technology. Schumpeter (1934, 1942) viewed technical advance as a central feature of modern capitalism and later emphasized major innovations, so the emphasis on technological innovation in contemporary research is perhaps understandable. In rarer instances, organizational innovations, such as adoption of a new organizational form (Tolbert & Zucker, 1983) or the development of an administrative innovation (Scott & Backman, 1990), have been studied.

Although service organizations and industries are a major economic force in the contemporary U.S. economy, research and theory exploring innovation in service delivery are rare (for a notable exception, see Quinn [1992]). In the 1990s, the innovative packaging and delivery of financial instruments have played a prominent role in investment banking, and yet the study of innovation in professional service firms and professional service industries is a relatively rare event. Research and development in financial services is not without cost, but the cost of developing a technological innovation in capital-intensive industries can reach millions of dollars. Focused research on the lower-cost, nontechnological innovations typical of service industries may reveal theoretical insights into organizational context issues not yet conceptualized. Or such research may reveal scope limitations of insights derived from the study of technology-rich industries. For example, should one expect to see problems of innovation in 80-year-old investment banks with billions of dollars in assets—firms similar to some of those Dougherty and Harding documented in their study? Does inertia due to organizational size and age in firms with a history of stable operations focused on mature product lines consistently produce the same problems of innovation Dougherty and Harding observed? Or are there limitations on this effect that are as yet undocumented because researchers tend to generalize from studies of innovation in manufacturing industries rather than from the study of service industries? Perhaps this issue concerns a more general distinction than the service/manufacturing dichotomy; perhaps the issue is the extent to which powerful institutional forces regulate an organizational field. Thus, a study of innovation in investment banking firms may reveal significant effects of deregulation on innovation resulting from the blurring of boundaries between product offerings allowable across financial service firms after deregulation. Sample and population choices influence the generalizability of the insights derived from a given study. Cross-industry, comparative studies are indicated for the study of innovation, to increase researchers' confidence in the generalizability of extant theory.

Taken together, the articles that follow provide theoretical insight and extend empirical knowledge of the relations among communities, populations, organizations, and innovation. We challenge those who read these articles to analyze further gaps in the knowledge base. And we urge readers to act, to design and execute studies of innovation in service industries, to collect data on approaches to innovation among organizations in emerging economies like Vietnam, to counter the charge that theories of innovation are ethnocentric and uninformed by internationally based comparative research. Since joint ventures and strategic alliances are increasingly visible between U.S. firms and organized entities in Eastern Europe and China, a comparative, cross-national, study of alternative forms of organizing for innovation would be a welcome addition to the knowledge of innovation in organizations on a more global scale.

To remain a forcible component of theories of organization, research on innovation needs to better reflect contemporary research methods and theoretical perspectives. The articles in this Special Research Forum on Innovation and Organizations illustrate some of the best contemporary research available. They show that research on innovation no longer reflects the narrow but pressing interests of those charged with managing innovation in today's complex world of organizations. And yet, our very theories of innovation must reflect changes in how innovations are produced and influenced by multiple factors: (1) global, multicultural, and international influences and (2) managers' insatiable hunger for knowledge about how to innovate in a world obsessed by speed, short cycle times, and high quality. The management of innovation in contemporary organizations is indeed a daunting task, but no less so than the task before our research community: development of a more complex and yet more refined understanding of innovation in the contemporary world of organizations.

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THE MARKET FOR CORPORATE CONTROL AND FIRM INNOVATION

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This research examines an integrated theoretical model that explains how strategies for participating in the market for corporate control (acquisitions and divestitures) affect internal control mechanisms and, together, influence internal and external innovation. Nine out of ten hypotheses received support, with results showing that firms engaging in acquisitions and divestitures emphasize financial controls, deemphasize strategic controls, and thereby produce less internal innovation. Furthermore, these firms are likely to seek external innovation to gain short-term benefits in competitive advantage. We conclude that engaging in the market for corporate control strongly affects the context in which innovation is framed, the control mechanisms employed, and the design and process of innovation.

Mergers and acquisitions have been a significant firm strategy for many years. For example, during the 1970s and 1980s, the fourth wave of mergers and acquisitions in this century (Golbe & White, 1988; Walsh & Kosnik, 1993) was observed. There were over 55,000 such deals in the 1980s, valued at just under $2 trillion. In fact, almost $250 billion was invested in acquisitions during 1988 alone (Weston & Chung, 1990). Moreover, although there was a reduction in such activity in the early 1990s, more dollars were invested in acquisitions during 1994 than in any previous year (Steinmetz, 1995).

Concurrent with the heavy merger and acquisition activity, firm innovation in the form of new products and processes has become increasingly important as a way for companies to achieve and maintain a competitive advantage (Franko, 1989). The technological revolution and greater competition in international markets have increased the competitive importance of innovation (Hitt, Keats, & DeMarie, 1995). In fact, a new competitive landscape is forming, in which rapid technological change and diffusion and

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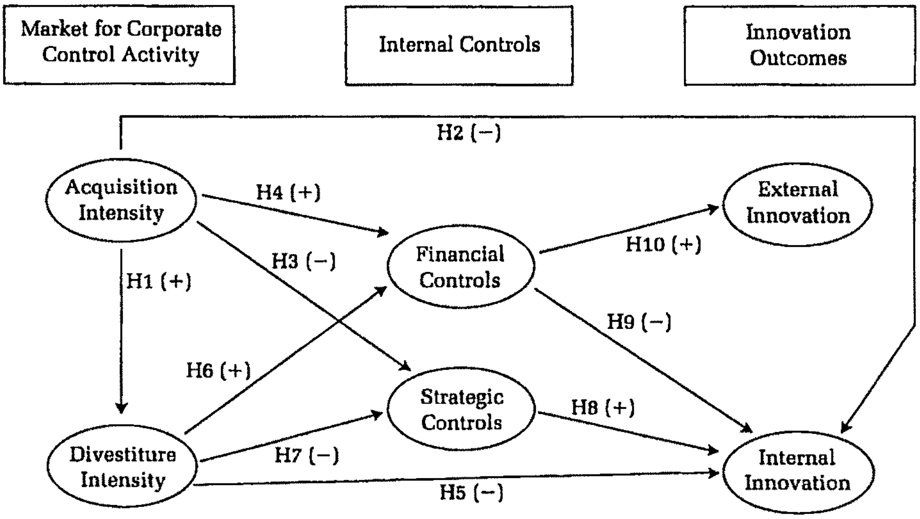
increasing knowledge intensity are salient features (Bettis & Hitt, 1995). Thus, firm innovation has become important for value creation in many industries. Unfortunately, the market for corporate control often has not created the value expected and has harmed companies' innovative capabilities (Hitt, Hoskisson, Ireland, & Harrison, 1991a, 1991b). The market for corporate control is defined as the transferring of managerial control to new capital providers (e.g., shareholders) through acquisitions, divestitures, and other control-transfer mechanisms. Essentially, it is the market for buying and selling businesses or parts thereof (Manne, 1965).

Although Jensen (1993) argued that the failure of the market for corporate control regarding innovation is partly due to legal restrictions on the capital market (e.g., Roe, 1990), he suggested that the major source of failure is "internal control systems." By this term he means the overall governance systems of firms, including poor managerial incentives. Jensen's argument implies that internal control systems designed to regulate managerial behavior, especially that of divisional managers, may have critical effects on firm innovation. Jensen (1993) provided evidence that internal control systems have not produced effective R&D and capital expenditure allocations. Seward and Walsh (1995) concluded that the effects of acquisitions and divestitures on shareholder wealth could be largely attributed to internal managerial control practices. The management literature has partially addressed the relationship of governance and innovation activities (e.g., Baysinger, Kosnik, & Turk, 1991; Graves, 1988; Hansen & Hill, 1991; Hill & Snell, 1988), but more research is required to precisely explain the relationships involved. Thus, there is need for research that examines the problems identified by Jensen (1993) and explores the effects of acquisition and divestiture activity on internal managerial controls and the consequent effects of these controls on firm innovation. In particular, there is a need to examine these relationships in a systemic integrated model.

In the reported research, we developed a model integrating strategic activities related to the market for corporate control, internal control mechanisms, and forms of firm innovation. The purpose of this research was to test this systemic model of the effects of buying and selling assets (acquisitions and divestitures) on firm innovation. Figure 1 depicts the theoretical model developed and tested.

In prior research, Hitt and colleagues (1991b) found acquisitions to have a direct negative effect on firms' R&D intensity. Furthermore, Hoskisson and Johnson (1992) found that divestment activity that refocused firms had a direct, positive effect on R&D intensity over time. Jensen (1993) argued that firms' R&D performance had suffered largely because of the failings of internal control systems. Acquisitions and divestments are strongly linked to internal control systems (Hoskisson & Hitt, 1994). However, to gain a clear understanding of the relationships among firms' participation in the market for corporate control, their internal control systems, and their innovative capability and productivity, there is need to test these relationships in a systemic, integrated model. The current study extends prior research by

FIGURE 1
Theoretical Model



developing more sophisticated measures of acquisition and divestment activity and examining how they affect the internal development of innovation (investment in R&D and new product introductions to the market) and the external acquisition of innovation (such as acquiring firms with new products), both directly and through the use of specific internal controls (financial and strategic). Importantly, it examines these relationships in the systemic integrated model illustrated in Figure 1. Below, we explain the theoretical model and each of the expected relationships and present the hypotheses tested in this study.

THEORETICAL MODEL AND HYPOTHESES

Firms that are actively seeking and completing acquisitions, managing a portfolio of businesses (acquiring and divesting), or only divesting businesses are all active in the market for corporate control. A firm may follow an acquisition strategy for several reasons. A primary reason for acquisitions is to achieve greater market power. Acquisitions may be used to increase the size of a firm and its resources and capabilities, all of which can improve its ability to compete, especially in the global marketplace. Additionally, a firm may use acquisitions to overcome barriers to entry into desirable markets. In fact, acquiring a firm in industries with high entry barriers may be the only way to enter such markets (Balakrishnan, 1988). Often, market entry through acquisitions can be less costly, require less time, and achieve a more profitable return than internal new ventures. Target firms have track records that can be carefully analyzed; future revenues and costs can be forecasted from historical records. So acquisitions often represent more certainty and lower risk than do new ventures. Although it may be easier to develop new products for a firm's existing markets internally, it is more difficult to develop and successfully enter new markets that the firm's managers do not understand well. Thus, acquisitions also represent a popular way of diversifying, and managers may prefer to enter new markets through acquisitions. Finally, firms may use acquisitions to enter related and unrelated markets to reduce dependence on markets with substantial competitive pressure (Hitt, Ireland, & Hoskisson, 1995) or with severe cyclicity (Amit & Livnat, 1988).

Similarly, firms divest assets for several reasons (Hoskisson, Johnson, & Moesel, 1994; Johnson, 1996). Divesting firms often seek to correct strategic mistakes and improve their performance, so they may divest businesses to obtain significant new cash flows with the purpose of strategically refocusing on their core businesses and core competencies. Divestiture may be necessary because of overdiversification (Markides, 1992). Thus, firms may divest businesses to restructure their portfolios of assets, reduce debt associated with heavy acquisition activity, and improve the innovative competitiveness of existing businesses.

Regardless of the reason for acquisitions and divestitures, research suggests that buying and selling activity may ultimately have an effect on a firm's level of innovation and the type of innovation sought. However, to understand this effect, one must examine a causal network among acquisition and divestiture activity, internal control systems, and internal and external innovation. Below, we describe a systemic, integrated model of the relationships among these variables. The first relationship examined is the link between acquisitions and divestitures.

Acquisitions and Divestitures

Because acquisitions are a major source of firm growth, over time they may lead to the need for divestitures (Porter, 1987). Acquisitions frequently produce little or no return to acquiring shareholders (Jensen, 1988), so some acquiring firms evidently have been unable to achieve the desired synergy with the acquired assets. When this occurs, firms seek to divest those assets to reduce future losses and thereby improve firm value. Ravenscraft and Scherer (1987) found that almost one-third of the businesses acquired by the firms they studied were subsequently divested. Additionally, firms following an acquisition strategy, particularly for the purpose of diversification, may overdiversify (Hoskisson & Hitt, 1994; Markides, 1992; Shleifer & Vishny, 1991). Roll (1986) suggested that managers may overvalue their ability to manage new businesses, exhibiting hubris that leads to excessive diversification. In overdiversified firms, top executives find it difficult to effectively manage the many separate businesses, and thus firm value decreases. Later, these firms seek to strategically refocus by divesting assets that are unrelated to their core businesses (Johnson, 1996).

Often, acquisitions require substantial financial resources, and firms have commonly used leverage as one source of such capital (Hitt, Hoskisson, & Ireland, 1990; Hoskisson, Hitt, & Ireland, 1994). As firms use greater amounts of leverage, their financial risk increases. At times, debt costs (repayment of principal and interest) can be substantial. In fact, the payment of debt costs may require significant cash flow. Firms with high debt costs may require new cash flows to repay the debt and reduce their financial risk (Hitt & Smart, 1994), so active acquirers may divest assets to create greater cash flow. Hoskisson, Johnson, and Moesel (1994) showed that divestiture programs are positively associated with high relative debt and high relative diversification (overdiversification). Finally, firms following an active acquisition strategy may seek to divest assets in order to change their portfolios of assets. In fact, some firms are continuously acquiring and divesting businesses in the management of their asset portfolios. For these reasons, we expected a positive relationship between acquisitions and divestitures.

> *Hypothesis 1: Acquisition intensity is positively related to divestiture intensity.*

Acquisitions and Innovation

Acquisitions often entail substantial transaction costs that result in acquiring firms not realizing gains from acquisitions (Barney, 1988). Transaction costs include negotiating, bidding, monitoring, and enforcement costs resulting from transaction difficulties in the exchange process. Among the potential relevant transaction difficulties are "bounded rationality" and uncertainty and complexity (Jones & Hill, 1988). Acquisition negotiations are often highly complex, with multiple parties involved, including investment bankers, lawyers, and top executives from both firms. To extract the highest price possible for its shareholders, target firm managers attempt to exchange only information that can positively affect the acquisition price. Information asymmetries between the two parties often result. Finally, the complexity and information asymmetries are exacerbated by the bounded rationality of the primary actors on each side of the acquisition negotiations. Thus, acquiring firms may not easily nor accurately predict potential synergy between the target and acquiring firm assets. This lack of accuracy may lead to problems in integrating the acquired assets into the acquiring firm and to economies of scale and scope that are lower than predicted (Haspeslagh & Jemison, 1991; Jemison & Sitkin, 1986). Ineffective integration processes may harm internal innovation efforts, particularly if they draw attention and resources from such efforts (Pritchett, 1985). Internal innovation refers to the development and introduction of new products and processes.

The acquisition process often absorbs significant amounts of managerial time and energy, thereby diverting managerial attention from other important activities (Haspeslagh & Jemison, 1991). Acquisitions require extensive preparation and negotiations. Firms with an active acquisition strategy must conduct searches for viable acquisition candidates, which generally involves extensive data gathering and analyses. Although executives rarely gather the data and perform the analyses, they must review the results of those analyses and select appropriate acquisition targets. After selecting targets, they must formulate an effective strategy to acquire the firms and begin the negotiations. These negotiations frequently consume much time, particularly if an acquisition bid is undesired by the target firm (Hitt et al., 1990). During this process, the attention of several members of a top management team may be diverted from internal activities, particularly important long-term investments such as developing and bringing new products to the market.

Target firm executives also have to exert much energy and attention toward acquisition negotiations. Activities in target firms being vigorously pursued often enter a state of "suspended animation" (Hoskisson, Hitt, & Ireland, 1994). Daily operations continue unabated, but decisions requiring long-term commitments are often postponed, pending the outcome of the acquisition negotiations. Managers of a target firm are frequently reluctant to make long-term commitments of resources (e.g., heavy investments in R&D), unless they are made for defensive purposes—for instance, to reduce the firm's cash position, making it a less attractive acquisition candidate. Therefore, the process of acquisition often creates a short-term perspective and heightened risk aversion among the top-level managers of both the acquiring and target firms.

Once an acquisition is completed, the process of integrating the acquired assets becomes critical (Fulmer & Gilkey, 1988; Shrivastava, 1986). Because of the importance of gaining synergy between the two sets of assets and the complexity involved in the integration process, much managerial time and energy is devoted to this process in successful acquisitions. Thus, an acquisition may consume considerable amounts of managers' energy over substantial time periods. Therefore, firms following an active acquisition strategy may have lower managerial commitment to internal innovation (Hitt et al., 1990).

Firms following an active acquisition strategy often need substantial resources to complete their acquisitions and thus resort to the use of debt, as noted above. Doing so creates debt costs that must be traded off against the use of these resources for other purposes. Constable (1986) concluded that diversification by acquisition diverted investments from internal development. Furthermore, debt holders frequently impose strict rules that include higher costs for risky projects with assets that are not redeployable for other purposes (Williamson, 1988). The creation of innovation through internal development (R&D) involves assets that are largely nonredeployable. As a result, debt holders are likely to prefer the use of debt to fund acquisitions rather than to support innovation activities. Increased leverage, then, is likely to lead to greater risk aversion on the part of managers. In turn, risk aversion reduces managerial commitment to innovation.

Finally, firms following an active acquisition strategy may use acquisitions as a substitute for internal innovation. Managers often perceive internally developed innovation as entailing a high risk because of the low probability of success and the length of time required for new innovations to produce adequate returns (Clark & Malabre, 1988; Hill & Snell, 1989). For example, Biggadike (1979) found that new ventures require multiple years to achieve profitability and even more to generate adequate cash flows. Furthermore, a significant number of innovations fail to achieve adequate returns on their investment (Mansfield, 1969). This problem has intensified in recent years because the increasing pace of technological change and heightened global competition have shortened the amount of time that firms have to achieve adequate returns on their innovation investments (Bettis & Hitt, 1995).

The preceding arguments suggest that firms involved in an active acquisition strategy may invest less in the internal development of innovation than other firms. Transaction costs make it difficult to understand and realize potential synergies, acquisitions often absorb much managerial time and energy, and acquisitions use significant resources, which are often at least partially financed by debt. Finally, investments in acquisitions may be perceived as less risky than investments in innovation and yet offer new products, processes, or markets to acquiring firms. As a result, we expect a negative relationship between acquisition activity and internal firm innovation.

> *Hypothesis 2: There is a negative relationship between acquisition intensity and internal firm innovation.*

Acquisitions and Internal Controls

Hoskisson and Hitt (1988) argued that two types of major internal controls associated with the management of large firms, particularly diversified firms, have an important effect on firm innovation: strategic controls and financial controls. Strategic controls entail the use of long-term and strategically relevant criteria for the evaluation of business-level managers' actions and performance. Strategic controls emphasize largely subjective and sometimes intuitive criteria for evaluation (Gupta, 1987). The use of strategic controls requires that corporate managers have a deep understanding of business-level operations and markets. Such controls also require a rich information exchange between corporate and divisional managers (Hoskisson, Hitt, & Ireland, 1994).

Alternatively, financial controls entail objective criteria such as return on investment (ROI) in the evaluation of business-level managers' performance. They are similar to what Ouchi (1980) and Eisenhardt (1985) referred to as outcome controls. Thus, top-level managers establish financial targets for each business and measure the business-level managers' performance against those targets. Such an approach can be problematic when the degree of interdependence among business units is high. Thus, emphasis on financial controls requires each division's performance to be largely independent of that of other divisions; for instance, there would be little resource sharing between divisions (Goold & Campbell, 1987; Hill & Hoskisson, 1987; Jones & Hill, 1988).

Firms following an active acquisition strategy may add whole firms or multiple businesses to their portfolios with each acquisition. Sometimes, acquisitions add substantial numbers of new assets and multiple markets to a firm's original portfolio. Thus, as a firm grows through acquisition, it also grows in complexity and the number of units that corporate executives must oversee and manage (thereby increasing their spans of control). Clearly, each acquisition increases corporate managers' need for information processing, sometimes dramatically so. These changes make it difficult for corporate managers to use strategic controls. To reduce information-processing demands, they may change their emphasis from strategic to financial controls.

As noted earlier, acquisitions are a primary means of diversifying firms. As a firm acquires businesses that are different from its current core businesses or portfolio of businesses, additional information-processing demands are placed on corporate managers. In fact, major diversifying acquisitions can change a firm's center of gravity (Galbraith & Kazanjian, 1986). A firm's center of gravity is established by its initial operations in a specific industry at a particular stage in a product-market stream. Each industry has specific, and often different, critical success factors. If multiple acquisitions produce extensive diversification, or even changes in the firm's center of gravity, corporate managers may begin to experience control loss. Control loss occurs when corporate managers are not adequately informed about the internal operations or the external environments of major businesses (e.g., divisions) (Ellsworth, 1983). This problem results from the corporate managers' lack of knowledge of the acquired firms' business operations and markets. Furthermore, top managers are often unable to adequately attenuate the information asymmetry between themselves and business-level managers. Thus, as a result of bounded rationality alone, highly diversified firms may overload the ability of corporate managers to process the necessary information and adequately evaluate and control business-level managers' performance (Williamson, 1985).

Although development of highly sophisticated management information systems has helped corporate managers in this regard, effective strategic control often requires the use of face-to-face communication to obtain the rich information necessary to make appropriate subjective assessments using strategically relevant criteria (Chandler, 1991; Goold & Campbell, 1987). Thus, as firms acquire more businesses, particularly ones that are unrelated to their current core businesses, corporate managers often change the emphasis of the controls they use from a strategic (more subjective) to an objective (often financial) one. Objective criteria do not require extensive knowledge of each business operation and its markets.

Corporate culture (a set of core values shared by organizational members) can also help corporate managers control business-level operations (Kilmann, Saxton, & Serpa, 1986). However, a firm following an active acquisition strategy often finds it difficult to maintain a common corporate culture throughout the total organization; such a widespread culture has been called a clan control system (Ouchi, 1980). Firms that are acquired have their own corporate cultures, and these cultures may differ, sometimes significantly so, from the acquiring firm's culture. A common corporate culture facilitates the use of strategic controls (Hill, Hitt, & Hoskisson, 1992). However, firms with multiple and diverse cultures find it difficult to implement common strategic controls. Thus, they are more likely to emphasize financial controls.

These arguments suggest that firms following an active acquisition strategy are likely to emphasize financial controls and deemphasize the use of strategic controls. Thus,

> *Hypothesis 3: Acquisition intensity is negatively related to the use of strategic controls.*
>
> *Hypothesis 4: Acquisition intensity is positively related to the use of financial controls.*

Divestiture Intensity and Firm Innovation

Firms divest businesses or portions thereof for multiple reasons. One of the most common reasons they do so is because of poor performance (Hoskisson et al., 1994; Jain, 1985). Undoubtedly, many firms' low performance is the result of poorly performing assets (businesses). Low performance from poorly performing assets is often related to strategic errors made in the acquisition process in earlier years. For example, some firms acquire businesses with unrealistic expectations of achieving synergy between the acquired assets and their current sets of assets. A common reason for such errors is managerial hubris (Roll, 1986) or overvaluation of managerial capability in the acquisition process.

Furthermore, firms that have used acquisitions to diversify reach a point of overdiversification, as described earlier (e.g., Hoskisson et al., 1994; Markides, 1992, 1995). They then may divest units that are unrelated to their core to strategically refocus or "downscope" (Hoskisson & Hitt, 1994). Divestitures help make adjustments to a firm's asset portfolio designed to induce a higher market return from that portfolio.

As noted earlier, firms often divest assets in order to increase cash flow, particularly where they have heavy debt loads. Thus, firms sell off assets to pay substantial debt costs (Hoskisson, Johnson, & Moesel, 1994; Scherer, 1988). Where debt costs are high, resources from divestitures of assets are used to pay the debt costs (Lee & Cooperman, 1989), rather than to make such long-term strategic investments as developing internal innovation (Hitt & Smart, 1994). Firms undergoing significant divestitures frequently operate as if in suspended animation (Hitt et al., 1990) and experience a period of "post-restructuring drift" (Johnson, Hoskisson, & Margulies, 1990). Many of these firms exist in highly turbulent environments—those characterized by significant technological change or substantial global competition, for instance—that produce disorder, disequilibrium, and significant uncertainty within the organizations (Prigogine & Stengers, 1984). As a result, managers often postpone significant long-term investments during the process of divestitures. Also, because of poor performance, high debt costs, or both, the firms do not have the appropriate resources to make significant investments that won't realize returns for several years. In addition, because of the significant uncertainty created by the substantial changes and the turbulent environment in which they exist, managers may find it difficult and undesirable to make long-term commitments.

After a deal is consummated, the divesting firm must engage in damage control within its remaining units (Nees, 1981; Taylor, 1988). The process of divestiture (and acquisition as well) can result in lower morale, higher turnover, and a decrease in productivity due to uncertainty and a lack of clear signals from top management (Hayes, 1972; Johnson et al., 1990; Nees, 1981; Walsh, 1988, 1989). As the level of distrust increases due to a lack of information from top management, communication and cooperation may decrease (Nees, 1981; Schweiger, Ivancevich, & Power, 1987). Managers and employees alike fear making mistakes that become visible to key decision makers because of job security concerns. Individuals afraid of making visible mistakes are conservative in their actions and therefore less innovative. This concern may continue for some time after a divestiture is completed, particularly in firms that have made multiple divestitures. Furthermore, divestitures disrupt existing communication networks, thereby constraining information flows. Innovations often are the result of combining information from disparate sources (Gemunden, Heydebreck, & Herden, 1992). Disruptions in communication flow can limit innovation. Thus, we expect a negative relationship between divestitures and internal innovation to prevail during a divestiture program.

> *Hypothesis 5: There is a negative relationship between divestiture intensity and internal innovation.*

Divestitures and Internal Controls

As noted earlier, firms that are widely diversified are expected to make heavier use of financial controls (Hoskisson & Hitt, 1988; Reece & Cool, 1978). These same firms are expected to have a lower emphasis on strategic controls (Hitt et al., 1990). Furthermore, previous research has suggested that firm performance is generally poor prior to divestiture (Duhaime & Grant, 1984; Hoskisson, Johnson, & Moesel, 1994; Jain, 1985; Johnson, 1996; Ravenscraft & Scherer, 1987). For example, Jain reported that firms exhibited negative abnormal returns of −10.8 percent prior to divestiture, and Duhaime and Grant reported that 40 percent of divested units were sustaining losses and 44 percent exhibited unacceptably low profits. There is growing evidence to suggest that most firms engage in cost and asset reduction to halt performance declines and stage successful turnarounds (Barker & Mone, 1994; Hofer, 1980; Robbins & Pearce, 1992). Such actions almost always entail strict cost reductions (Grinyer & McKiernan, 1990; Hambrick & Schecter, 1983). Strict cost reductions imply the increased use of tight financial controls (Hambrick & Schecter, 1983), including an emphasis on short-term cash flows and accounting returns like ROI, to help reduce expenses (Barker & Mone, 1994; Robbins & Pearce, 1992). We therefore expect firms engaging in divestitures to emphasize financial controls to improve their profitability.

Often making divestitures also requires significant time and effort on the part of top executives. For example, completing divestitures of assets entails many of the transaction costs described earlier for acquisitions. The process of divesting a business unit involves several stages—recognizing the need for divestitures, deciding to divest, selecting the assets to divest, finding a buyer, negotiating the sale, and obtaining ratification by the board (Taylor, 1988). The decision process may involve roadblocks such as sociopolitical issues and unwillingness to admit failure, which require further time on the part of top management. Taylor (1988) reported that executives perceive the divestiture process as similar to a divorce. Most of the executives in her study felt it was much easier (in terms of time and energy) to acquire a business than to divest one (cf. Hayes, 1972; Nees, 1981; Porter, 1976).

Divestitures differ from acquisitions in that the market for divested assets often follows a "Dutch auction" process in which the divesting firm initiates the transaction (as opposed to the buyer) and normally deals with only one buyer (Jain, 1985; Sicherman & Pettway, 1992). A Dutch auction implies that the firm sets a price for the unit to see if a buyer is interested. If no buyer comes forward, the unit price is reduced until a buyer is found or the firm decides to retain the unit. After a potential buyer is identified, the negotiation process begins. Latent problems in the business are hard to discover, making potential buyers cautious. Thus, potential buyers often bid the lowest possible amount (discounted present value of a continuing stream of depressed profits) for the unit. It may, therefore, take considerable time for the buyer and seller to reach a mutually agreeable price; Nees (1981) reported a range of 20 months to several years in her study. Spin-offs represent an alternative to divestitures because they don't require buyers, but the separation process is still difficult. For example, it is not clear how successful the AT&T breakup will be. It has been particularly disruptive for Bell Laboratories, the traditional engine of innovation for AT&T businesses (Ziegler & Gautam, 1995).

While managers are engaged in divesting units, they may not be able to maintain the characteristic openness of strategic control systems because of a lack of time and information-processing limitations exacerbated by the divestiture process. Rather, executives rely on more formal procedures, such as ex ante budgets and other financial controls, while a firm is actively involved in divesting business units because they require less time and energy (Johnson et al., 1990).

The previous arguments suggest that top management increases financial controls and reduces strategic controls as the number of divestitures increases. Thus,

> *Hypothesis 6: There is a positive relationship between divestiture intensity and financial controls.*
>
> *Hypothesis 7: There is a negative relationship between divestiture intensity and strategic controls.*

Internal Organizational Controls and Internal Firm Innovation

Strategic controls focus on long-term performance: managers in firms that emphasize strategic controls evaluate the strategies business-level managers formulate and the strategic actions they take rather than their outcomes (Chandler, 1991). Firms in which strategic controls are used often are more focused and emphasize the long-term development of their core businesses (Goold & Campbell, 1987; Hoskisson, Hitt, & Hill, 1991). Use of strategic controls helps establish a norm of risk sharing between corporate and business-level managers. Business-level managers are more likely to undertake risky projects because they feel that corporate managers understand their strategic proposals. Also, business-level managers believe they will be rewarded for the quality of their strategies rather than for short-term financial outcomes. In addition, with a strategic control emphasis, corporate managers frequently establish criteria to promote innovation in these businesses and reward division managers for meeting those criteria. So strategic controls promote increased managerial commitment to innovation (Hitt et al., 1990). This commitment can be observed in higher levels of investment in R&D and in managers' championing new product ideas to bring them to the market (new product introductions). Thus, we expect the use of strategic controls to promote more internal innovation.

> *Hypothesis 8: There is a positive relationship between strategic controls and internal innovation.*

In firms that emphasize financial controls, managers are evaluated on objective financial criteria such as ROI. Furthermore, managerial rewards are contingent on the achievement of these financial outcomes. ROI can be increased in the short term by reducing long-term expenditures, such as investments in R&D (Hayes & Abernathy, 1980). The effects of reducing these long-term investments will not be evident for several years. Because tenure in a specific managerial position is often less than five years, managers who reduce or postpone long-term investments are unlikely to be present when the outcomes of such actions become evident (Fredrickson, Hambrick, & Baumrin, 1988). Furthermore, if managerial compensation and other rewards such as promotion are tied to the achievement of short-term financial outcomes such as ROI, rational managers will take actions to achieve those outcomes (Hoskisson et al., 1991).

In contrast to corporate executives, business unit managers cannot diversify their employment risk. Therefore, proposing risky investments (e.g., R&D) or championing risky new product ideas places a business manager's future earnings (and career) at risk. Because financial performance outcomes are a function of managerial behavior, as well as other factors beyond managerial control, rewards based on financial outcomes shift some of the firm risk to the business-level manager (Eisenhardt, 1985). This shift of risk is likely to produce increased managerial risk aversion at the business level (Hitt et al., 1990). An emphasis on financial controls thus often leads to lower internal innovation (Hayes & Abernathy, 1980; Rappaport, 1978).

> *Hypothesis 9: There is a negative relationship between financial controls and internal innovation.*

Goold and Campbell (1987) found that firms with strong financial controls achieved growth largely by acquiring new operational units rather than by direct internal investment. In industries in which innovation is important to maintain competitive parity or gain competitive advantage, managers working under strong financial controls may still search for ways to bring innovation to their firms. Their search will, however, emphasize innovation with less risk and more certain short-term payoffs. As a result, they may attempt to identify businesses that have developed and introduced new products to the market or new processes that have achieved at least a measure of short-term success. They then seek to acquire these firms in order to incorporate the new products or processes into their firms. Such acquisitions may also help acquiring firms move into new markets. We should, therefore, expect firms with strong emphases on financial controls to seek external innovation.

> *Hypothesis 10: There is a positive relationship between financial controls and external innovation.*

In summary, the theoretical arguments presented above suggest that activity in the market for corporate control diminishes internal innovation. Activity in the market for corporate control produces significant transaction costs and absorbs substantial amounts of managerial time and energy, whether assets are being acquired or divested. As firms acquire more units, diversify through acquisition, or both, information-processing demands on corporate managers increase geometrically. They thus tend to emphasize financial controls over strategic controls. Firms using high levels of strategic controls produce more internal innovations, whereas firms using high levels of financial controls tend to produce fewer internal innovations but acquire more innovation externally. Firms restructuring through divestitures are often seeking to improve performance, pay debt costs, or change their portfolios of assets. This process requires much managerial time and energy, along with significant transaction costs. During the process of restructuring, there is likely to be internal turmoil, and managers may operate as if in a state of suspended animation. Thus, they are unlikely to make significant long-term investments or to change their control emphasis. We tested the integrated model posed herein using a complex research design and a multiyear, multisource data collection effort. The methodology used to test the proposed hypotheses is described next.

METHODS

Sample

The sample was drawn from Standard & Poor's COMPUSTAT Annual Data Tape and from the COMPUSTAT Business Segment Tape. The sampling frame consists of those firms that reported R&D expenditures each year between 1985 and 1991, with some operations in the industrial manufacturing segment (Standard Industrial Classification [SIC] codes 2000–4000). We focused on industrial firms because they form a major base for strategic competitiveness (Hitt, Keats, & DeMarie, 1995) and provide useful measures of internal innovation (e.g., investments in R&D, new product introductions). In addition, firms were required to have at least $25 million in total assets for each year of the study. We imposed this criterion to remove small start-up firms from the sample. The time frame was chosen because significant restructuring activity (acquisitions and divestitures) occurred during this period (Weston & Chung, 1990).

Information on divestitures and acquisitions was obtained from *Mergers & Acquisitions,* the *Wall Street Journal Index, Compact Disclosure,* and the popular business press (*Business Week, Fortune,* and so forth). A total of 776 firms had the necessary COMPUSTAT information. Of this total, 286 firms had all necessary data (including survey data). As 36 of these firms had completed their divestiture program by the end of the study period, we deleted them from the analyses, for consistency with the hypotheses. Thus, the resulting sample for this study was 250 firms.

Survey

Few studies have attempted to measure corporate internal control systems or the importance of external innovation (Hill et al. [1992] and Johnson, Hoskisson, and Hitt [1993] are exceptions). A survey was developed to measure type of controls and degree of emphasis on external innovation because this information is unavailable from secondary sources. CEOs and other top management team members were identified from *Standard & Poor's Directory of Corporate Affiliations.* We made an attempt to contact each firm's CEO by telephone to secure his or her cooperation in completing the survey. Response rates can be significantly increased when verbal commitment is obtained prior to sending a survey instrument (O'Keefe & Homer, 1987). In most cases, if the CEO could not be reached, a researcher spoke to a CEO designee. In some firms, no telephone contact was possible.

The survey was mailed in 1991 and responses were largely received in the summer and fall of 1991 (a few were received in early 1992). The overall response rate for the survey was 36.9 percent (286 out of 776). This response rate is quite high, given that surveys were completed by CEOs or their designees (usually a firm's chief financial officer or top officer in charge of strategic planning). Because time is scarce among this group, Gaedeke and Tootelian (1976) forecasted a 20 percent response rate from surveys of top executives. Additionally, our response rate exceeds that achieved by Nayyar (1993; 20.1 percent) and is similar to that of Finkelstein (1992; 34.5 percent), both of whom sought survey responses from top executives. Thus, our response rate can be considered quite good.

To check for potential nonresponse bias, we conducted *t*-tests to examine potential differences in all the COMPUSTAT-based variables used in the structural equation modeling procedure. There were no significant differences in firm performance (returns on assets, equity, or sales), R&D intensity, size (total assets, total sales, or number of employees), or current ratio between respondents and nonrespondents during the time period over which survey data were collected (i.e., 1991). These findings suggest that respondents did not differ from nonrespondents along the dimensions examined. Furthermore, there was no significant difference in average industry R&D intensity ($t = .79$) between respondents and nonrespondents, suggesting that industry response bias also is not a concern in this sample.

Measures

Data for the study were collected over three different time periods. Following previous research on corporate restructuring (e.g., Hoskisson & Johnson, 1992), we collected product diversification data for the two years prior to the year in which a firm began to engage in acquisition or divestiture activity, which we refer to as restructuring. Pre-restructuring years were used because diversification (control variable) has been argued to affect firm strategies and control systems (cf. Hoskisson & Hitt, 1988). We collected acquisition intensity and divestiture intensity data from the first three years of our study period beginning with the onset of the restructuring (activity started in 1985, 1986, or 1987) through 1991 (the end of the study period). For those firms engaging in no restructuring activity during the period of this study, 1985 was considered the base year, and product diversification data were collected for 1983–84). Survey data used to assess external innovation and control systems were collected in 1991, and the internal innovation data were collected in the period 1991–92. Firms that completed their restructuring activity prior to filling out the survey (a total of 36) were deleted to meet the assumptions of our theoretical arguments. We expected firms that had completed a planned restructuring to act differently than those in the process of restructuring. All other financial information was collected for 1990–91 and averaged to remove possible accounting inconsistencies or unusual effects in a given year.

Primary Variables

Acquisition intensity. Acquisition intensity was operationally defined using two indicators: (1) number of acquisitions completed and (2) percentage of sales acquired. The number of acquisitions was the total number of business units acquired during the restructuring period. The percentage of sales acquired was measured as the acquisition price of the unit being acquired divided by the acquiring firm's total sales during the previous year. This measure is similar to that used by Simmonds (1990). These percentages were summed over the years the firm acquired businesses to obtain the total percentage of sales acquired.

Divestiture intensity. Divestiture intensity was defined using two different indicators: (1) number of divestitures made, and (2) percentage of sales divested. Number of divestitures was the total number of business units sold through sell-offs, buyouts, or equity "carve outs" or spun off during restructuring (Hoskisson, Johnson, & Moesel, 1994; Johnson et al., 1993). The percentage of sales divested was measured as the sales price of a sold unit divided by its total sales for the previous year. This measure is similar to that used by Bethel and Liebeskind (1993) and Hoskisson, Johnson, and Moesel (1994). In the absence of a publicly reported price for a divestiture, we used the unit's sales for the previous year to serve as a proxy for this price because publicly reported prices often approximate this figure. These percentages were summed over the years a firm restructured to derive the total percentage of sales divested.

Financial controls. The financial control factor was composed of four items modified from a scale reported in Hill and colleagues (1992). These items assessed the importance of financial control measures and procedures in evaluating divisional managers' performance on a seven-point Likert scale. The four items were (1) return criteria such as return on assets, return on invested capital, and so forth, (2) cash flows, (3) objective strategic criteria such as return on investment, and (4) formal reports from management information systems received by headquarters. The coefficient alpha for this scale was .70.

Strategic controls. We measured strategic controls used by top management to process external and internal information in order to evaluate business unit strategy and allocate resources using survey items. These items indicate the emphasis on using strategic controls in evaluating division managers' strategies and performance on a seven-point Likert scale. The strategic control variable is composed of three survey items used by Johnson and colleagues (1993): (1) formal face-to-face meetings between headquarters and subunit personnel, (2) informal face-to-face meetings between headquarters and subunit personnel, and (3) subjective strategic criteria, such as attributes of marketing strategy internal to a firm. The coefficient alpha for this scale was .72.

External innovation. External innovation was composed of three items from the survey instrument asking to what extent a firm had made (1) external acquisitions of new products, (2) external acquisitions to develop new processes, and (3) external acquisitions to build new markets. These three items describe the importance of external innovation to the firm on a seven-point Likert scale. The coefficient alpha for this scale was .73.

Internal innovation. Internal innovation was defined with two variables measuring different dimensions of the construct: (1) firm R&D intensity and (2) new product intensity. R&D intensity was a firm's reported R&D expenditure per $1,000 of sales. This variable is commonly used to assess inputs to the innovation process. We obtained new product data from Dialog's PTS New Product Announcements on-line database containing full-text news releases issued directly by companies and their authorized marketing representatives. The database includes both U.S. and international companies from the industrial manufacturing and service sectors. Announcements include the introduction of all types of new products and services, new processes, new technologies, product modifications, and licensing agreements. We scanned the database for the years 1991–92 to obtain the number of new products introduced. The search was constructed in such a way that duplicate announcements were removed from the sample. We then divided the mean number of new product announcements over the two years by mean annual firm sales to adjust for size effects in the number of new products introduced (Acs & Audretsch, 1987; Chaney, Devinney, & Winer, 1991). This variable is referred to as new product intensity.

Control Variables

Product diversification. The level of preacquisition or predivestiture product diversification was used as a control because it has been shown to influence R&D expenditures (Hoskisson & Hitt, 1988) and divestiture intensity (Bethel & Liebeskind, 1993; Hoskisson, Johnson, & Moesel, 1994; Markides, 1992), and to be related to acquisition intensity (Hitt et al., 1991b). We calculated level of product diversification using the entropy measure (Jacquemin & Berry, 1979; Palepu, 1985) and the approach specified by Davis and Duhaime (1992). The following formula was used: *entropy measure* = $\Sigma P_j \times \ln(1/P_j)$, where P_j is defined as the percentage of firm sales in segment j and $\ln(1/P)$ is the weight for each segment j. This measure, therefore, takes into account the number of segments in which a firm operates and the relative importance of each segment in sales (Palepu, 1985). This continuous measure of diversification has been found to have good construct validity relative to other diversification measures (Chatterjee & Blocher, 1992; Hoskisson, Hitt, Johnson, & Moesel, 1993).

Firm size. Firm size has been shown to influence both R&D expenditures (Baysinger & Hoskisson, 1989) and product introductions (Chaney & Devinney, 1992; Chaney et al., 1991). In addition, firm size is related to firm diversification and acquisitions (Bettis, 1981; Hoskisson et al., 1993; Montgomery, 1982), and divestiture intensity (Hoskisson & Johnson, 1992; Hoskisson, Johnson, & Moesel, 1994). We calculated firm size by using the logarithms of total assets, total sales, and number of employees as indicators. Industry-adjusted firm size was calculated by subtracting the average values of the above-mentioned variables for the dominant two-digit SIC code industry from their firm counterparts.

Average industry R&D intensity. Previous research has shown that average industry R&D intensity has an effect on the relative levels of R&D intensity at the firm level and new product introductions (Baysinger & Hoskisson, 1989; Chaney & Devinney, 1992; Hoskisson & Johnson, 1992). Average industry R&D intensity may also reflect a firm's need to remain in technological parity with competitors, thus necessitating external innovation if internal innovation is not forthcoming. We defined average industry R&D intensity with two indicators: (1) average industry R&D divided by average industry sales and (2) average industry R&D divided by average industry total assets. Average industry R&D intensity was calculated using average industry R&D, sales, and total assets at the two-digit SIC code level.

Accounting performance. High levels of firm performance have been shown to influence R&D spending and new product introductions (Chaney & Devinney, 1992). High performance may also influence a firm's ability to engage in acquisition activity and external innovation. We measured accounting-based performance using three indicators: (1) return on assets (ROA), (2) return on equity (ROE), and (3) return on sales (ROS). Each measure was calculated by dividing net income by total assets, total common equity, and total net sales, respectively. To control for industry effects, we adjusted ROA, ROE, and ROS for industry by subtracting the dominant two-digit industry average ROA, ROE, and ROS from their respective firm counterparts.

Current ratio. A standard measure of liquidity, the current ratio (current assets/current liabilities) has been found to influence the amount of funds available for R&D (Baysinger & Hoskisson, 1989; Hitt et al., 1991b).

Interrater Reliability

In order to assess interrater reliability for survey items, we sent duplicate surveys to a random sample of 130 responding firms. A total of 62 firms returned the duplicate questionnaire for a response rate of 47.7 percent. Fifty-five of the duplicate surveys were usable. The interrater reliability was .74 ($p < .0001$) for the strategic control factor, .76 ($p < .0001$) for the financial control factor, and .81 ($p < .0001$) for the external innovation factor. These results provide strong support for the reliability of these measures. Furthermore, they strongly suggest that the survey measured firm attributes as opposed to individual idiosyncratic interpretations. Table 2, which appears in the Results section, reports additional construct validity information concerning the factor loadings and significance levels of the confirmatory factor analysis. Overall, the results suggest good construct validity.

TABLE 1
Means, Standard Deviations, and Correlations[a]

Variable	Mean	s.d.	1	2	3	4	5	6	7	8
1. R&D intensity	4.78	6.17								
2. New product intensity	0.02	0.04	.51							
3. External acquisition of new products	4.16	1.73	−.03	−.01						
4. External acquisition to develop new processes	3.40	1.57	−.07	−.18	.58					
5. External acquisition to build new markets	4.22	1.71	−.08	−.20	.43	.45				
6. Return on investment criteria	5.78	1.50	−.25	−.30	.11	.13	.14			
7. Cash flows	5.39	1.58	−.11	−.14	.02	.05	.11	.45		
8. Objective strategic criteria	5.49	1.46	−.20	−.24	.13	.19	.14	.46	.42	
9. Formal reports from MIS systems	4.77	1.62	−.10	−.17	.11	.17	.11	.22	.29	.42
10. Formal face-to-face meetings	6.05	1.34	.18	.12	.07	.01	.12	.10	.13	.09
11. Informal face-to-face meetings	5.72	1.45	.17	.14	.05	.08	.07	.10	.16	.09
12. Subjective strategic criteria	4.93	1.40	.22	.15	.07	.14	.05	.07	.10	.10
13. Number of acquisitions	6.41	7.55	−.19	−.48	.16	.19	.28	.18	.17	.15
14. Percent of sales acquired	16.89	18.67	−.08	−.24	.22	.19	.30	.13	.11	.15
15. Number of divestitures	4.18	8.74	−.26	−.35	−.08	.10	.01	.16	.16	.15
16. Percent of sales divested	8.39	7.52	−.18	−.22	−.08	.01	.01	.11	.15	.11
17. Product diversification	0.47	0.52	−.29	−.48	.01	.15	.13	.18	.15	.24
18. Firm total assets[b]	6.62	1.86	−.19	−.62	−.01	.17	.05	.11	.03	.21
19. Firm sales[b]	6.83	1.79	−.22	−.62	−.02	.15	.05	.14	.02	.24
20. Firm employees[b]	1.90	1.65	−.20	−.59	−.03	.14	.04	.16	.02	.23
21. Current ratio	2.12	0.91	.25	.44	.06	−.08	.09	−.15	−.15	−.06
22. Industry R&D/sales	4.47	2.35	.34	.40	.11	−.05	.02	−.29	−.07	−.18
23. Industry R&D/assets	4.28	2.19	.32	.35	.14	−.03	.01	−.27	−.07	−.17
24. Industry-adjusted ROA	1.89	7.60	−.04	−.04	.15	.10	.12	.04	−.19	.01
25. Industry-adjusted ROS	0.53	13.94	−.05	−.06	.16	.10	.11	.06	−.18	.01
26. Industry-adjusted ROE	1.42	22.72	−.04	−.10	.13	.08	.10	.06	−.16	.01

[a] Correlations greater than or equal to .19 are significant at $p < .001$; those greater than or equal to .15 are significant at $p < .01$; those greater than or equal to .12 are significant at $p < .05$; and those greater than or equal to .10 are significant at $p < .10$.

[b] Variable is a logarithm.

General Model (Structural Equation) Method

The hypotheses were tested using structural equation modeling. By definition, structural equation analysis is a combination of factor analysis and path analysis. Our approach to estimating the structural equations model follows the two-stage procedure recommended by Anderson and Gerbing (1988). The first stage involves estimation of the measurement model using confirmatory factor analysis. This stage tests whether or not the variables selected to measure each construct exhibit sufficient convergent and discriminant validity. Once a good measurement model is established, the final stage tests the theoretical model (for a complete explanation of the decision tree process used, see Anderson and Gerbing [1988] and Bollen [1989]).

RESULTS

Table 1 reports means, standard deviations, and correlations between all variables used in the study. Analysis of the correlation matrix shows initial

TABLE 1 (continued)

9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
.10																
.10	.69															
.05	.35	.41														
.17	–.09	–.11	–.16													
.17	–.09	–.08	–.14	.57												
.09	–.11	–.10	–.13	.28	.09											
.15	–.11	–.08	–.11	.08	.12	.71										
.01	.01	–.01	–.08	.39	.17	.36	.18									
.04	.11	.06	.10	.39	.10	.35	.16	.51								
.04	.09	.04	.09	.39	.11	.34	.12	.50	.97							
.06	.08	.04	.07	.40	.11	.32	.10	.51	.93	.95						
–.06	–.02	.05	–.02	–.20	–.10	–.28	–.19	–.32	–.46	–.46	–.45					
–.07	.04	.11	.05	–.19	.01	–.25	–.12	–.35	–.36	–.40	–.36	.25				
–.06	.05	.13	.03	–.17	.03	–.24	–.09	–.34	–.35	–.38	–.35	.25	.94			
–.05	.01	.06	–.07	.02	.03	–.14	–.13	.01	.16	.19	.17	.26	.05	.04		
–.04	.01	.06	–.08	.02	.04	–.15	–.11	.01	.18	.20	.16	.24	.05	.04	.90	
–.01	.01	.04	–.11	.08	.07	–.13	–.10	.08	.21	.23	.21	.16	.02	.05	.85	.85

evidence of good convergent and discriminant validity. Nine of 11 correlations greater than .60 involve intrafactor correlations. The other two correlations are both .62 and reflect part of the important control path from firm size to new product intensity.

Overview of Structural Equation Modeling Results

Tables 2–5 and Figure 2 summarize the results derived from the structural equation modeling.

Table 2 summarizes the results of the confirmatory factor analysis (first stage of the modeling procedure) on the initial measurement model (model 1). Measurement information from the final "best" model (model 5) is also included for comparative purposes. Each variable is named and linked with a factor; a factor loading and its associated *Z*-statistic, where applicable, are reported for both models 1 and 5. Table 3 presents summary statistics of all models estimated in both stages of the modeling procedure as well as chi-square statistics and goodness-of-fit information for each model.

As the factor loadings for model 1 in Table 2 show, the expected mea-

TABLE 2
Factor Loadings: Measurement Model Compared to Final Best Model[a]

		Model 1, Measurement Model		Model 5, Final Best Model	
Variable	Factor Name	Loading	Z-statistic	Loading	Z-statistic
R&D intensity	Internal innovation	0.520***	7.252	0.518***	7.180
New product intensity	Internal innovation	0.974		0.978	
External acquisition of new products	External innovation	0.746***	7.872	0.749***	7.792
External acquisition to develop new processes	External innovation	0.753***	7.874	0.758***	7.790
External acquisition to build new markets	External innovation	0.615		0.605	
Return on investment criteria	Financial controls	0.664***	6.086	0.664***	6.110
Cash flows	Financial controls	0.622***	5.931	0.620***	5.943
Objective strategic criteria	Financial controls	0.699***	6.184	0.697***	6.208
Formal reports from MIS systems	Financial controls	0.483		0.485	
Formal face-to-face meetings	Strategic controls	0.804***	9.807	0.803***	9.748
Informal face-to-face meetings	Strategic controls	0.845		0.847	
Subjective strategic criteria	Strategic controls	0.486***	7.015	0.483***	6.965
Number of acquisitions	Acquisition intensity	1.000***	11.066	0.999***	11.067
Percent of sales acquired	Acquisition intensity	0.574		0.574	
Number of divestitures	Divestiture intensity	1.000***	15.764	0.995***	15.765
Percent of sales divested	Divestiture intensity	0.707		0.707	
Product diversification	Product diversification	1.000		1.000	
Firm total assets[b]	Firm size	0.977***	40.341	0.977***	40.359
Firm sales[b]	Firm size	0.994***	45.296	0.994***	45.290
Firm employees[b]	Firm size	0.952		0.952	
Current ratio	Current ratio	1.000		1.000	
Industry R&D/sales	Industry R&D intensity	0.993***	21.310	0.991***	21.382
Industry R&D/total assets	Industry R&D intensity	0.942		0.944	
Industry-adjusted ROA	Firm performance	0.952***	24.839	0.952***	24.838
Industry-adjusted ROS	Firm performance	0.951***	24.812	0.951***	24.812
Industry-adjusted ROE	Firm performance	0.890		0.890	

[a] This analysis allows a comparison of factor patterns throughout the modeling process.

[b] Measured as a logarithm.

*** $p < .001$

surement model performed very well. This conclusion is confirmed by the model chi-square statistic and goodness-of-fit measures for model 1 reported in Table 3. For instance, all of the factor loadings for model 1 in Table 2 are higher than .48. Factor loadings at the .40 level and above are routinely used in the social sciences (Ford, MacCallum, & Tait, 1986). Furthermore, there is good discriminant validity among the factors. Thus, all factors appeared adequate for use in the second stage.

The chi-square statistic and goodness-of-fit measures for model 1 in Table 3 reflect a very strong model. Goodness-of-fit measures of .90 and above on the Bentler-Bonett normed fit index (NFI) are considered desirable, and values of .95 and above on the comparative fit index (CFI) are generally considered strong evidence of practical significance (Bentler, 1989). Table 4 summarizes the hierarchical model testing sequence employed to compare the models and to determine the final best model (model 5).

We compared models 1–5 in Table 3 while examining the theoretical model (see Figure 1) and used sequential chi-square difference tests (SCDTs) to obtain successive fit information (Steiger, Shapiro, & Browne, 1985). Following a series of hierarchical tests, a final best model was derived that is both theoretically meaningful and free of obvious specification problems.

As presented in Table 3, the theoretical model (model 2) suggests the removal of five paths from the fully saturated model (model 1). Model goodness-of-fit measures are highly comparable across the two models. In Table 4, this comparison is summarized as the first step in the hierarchical sequence in the row labeled "model 2 vs. 1." The difference in chi-square is shown to be statistically significant, indicating that there is some misspecification in the theoretical model (model 2). Specifically, model 2 lacks a path or paths that are important to the overall fit of the model.

The second step involves the comparison of the next-best constrained model (model 3) with the theoretical model (model 2). In the next-best constrained model, one or more of the paths previously specified in the theoretical model are eliminated. In model 3, the next-best constrained model, we chose to drop the paths from divestiture intensity to financial and strategic controls to test the notion that the effects of divestitures on firm innovation are direct and not mediated by internal controls. Hoskisson and Johnson (1992) found a direct relationship between divestitures and investment in firm R&D. The comparison of model 3 to model 2 (Table 4) results in a significant chi-square statistic ($p < .005$), indicating that the theoretical model (model 2) is preferred over the next-best constrained model (model 3). These results suggest that the eliminated paths should be restored.

In the third step, we tested the next-best unconstrained model (model 4) against the theoretical model (model 2). The next-best unconstrained model contains all of the paths specified in the theoretical model plus one or more previously unspecified paths that represent important alternative theoretical arguments in the literature. For the next-best unconstrained model, we specified three new paths from acquisition intensity to external innovation, from strategic controls to external innovation, and from strategic controls to

TABLE 3
Model Statistics[a]

Model	Description	χ^2	*df*	*p*	NFI	NNFI	CFI
1	Measurement	387.970	246	<.001	.914	.955	.966
2	Theoretical	412.450	251	<.001	.909	.950	.962
3	Next-best constrained	435.111	253	<.001	.904	.944	.957
4	Next-best unconstrained	389.315	248	<.001	.914	.956	.966
5	Final model	390.456	250	<.001	.914	.956	.967

[a] NFI = Bentler-Bonett normed fit index, NNFI = Bentler nonnormed fit index, CFI = comparative fit index.

financial controls. Hitt and colleagues (1990) argued that in addition to the effects on internal innovation mediated by control systems, acquisitions could serve as a substitute for internal innovation, implying that firms may acquire innovation rather than develop it internally. Alternatively, firms that emphasize strategic controls are less likely to focus on external innovation. Strategic controls require knowledge of the businesses operated, and executives are less willing to acquire new businesses of which they have little understanding. Finally, although all firms normally use some amount of both strategic and financial controls, it has been argued that there is a tradeoff between the two, suggesting a negative relationship (i.e., Hoskisson & Hitt, 1988; Hitt et al., 1990). Thus, there are reasons to expect the relationships posed by the paths added to the model. The chi-square difference test reported in Table 4 is statistically significant, indicating that the next-best unconstrained model is preferred over the theoretical model.

In the fourth step, the next-best unconstrained model (model 4) is compared to the measurement model (model 1). The chi-square difference test presented in Table 4 was nonsignificant ($p > .10$), suggesting that model 4 is preferred over model 1. Lastly, we dropped the one path that was not significant in model 4. The test of the difference between the model 4 and model 5 chi-squares was nonsignificant ($p > .10$), indicating that model 5 (the most parsimonious model) is preferred. Anderson and Gerbing's (1988)

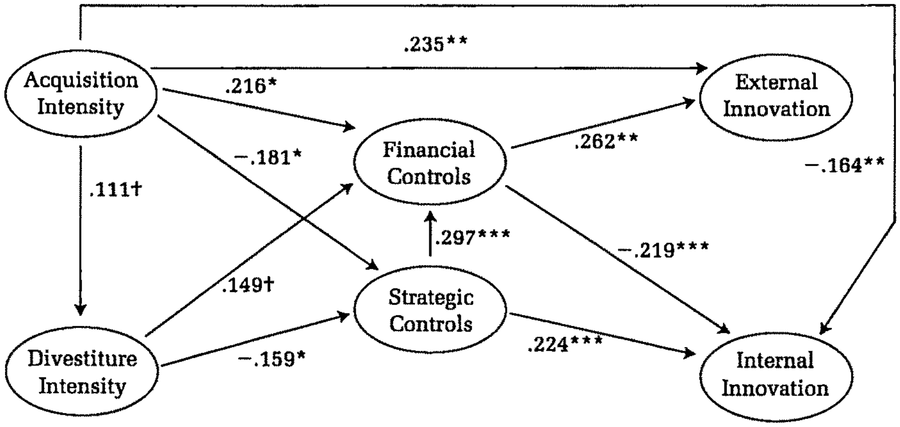
TABLE 4
Testing Sequence and Difference Tests

Comparison	$\Delta\chi^2$	Δdf	p^a	Model Preference
Model 2 vs. 1	24.480	5	<.005	1
Model 3 vs. 2	22.661	2	<.005	2
Model 4 vs. 2	23.135	3	<.005	4
Model 4 vs. 1	1.345	2	>.10	4
Model 5 vs. 4	1.141	2	>.10	5[b]

[a] Probabilities are stated in inequality terms as chi-square tables are sparse.

[b] Results of hierarchical modeling suggest acceptance of the final model (model 5) as the final best model. The modeling process was terminated at this point.

FIGURE 2
Final Model[a,b]



[a] Parameters are standardized parameter estimates. Terms in ellipses are factor names.

[b] This is a simplified version of the actual model. It does not show error terms, exogenous factor variances, disturbance terms, correlations between exogenous factors, or control paths from statistical control variables.

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

decision-tree framework suggests accepting the results of model 5 as the final best model.

Identifying a final best model without condition codes or other signs of misspecification allowed a test of hypotheses using the theoretical model (Figure 1 and model 2) and comparison to the final best model illustrated in Figure 2 (model 5).

Table 5 presents results for the theoretical path model illustrated in Figure 1 (model 2 in Table 5). For purposes of direct comparison, we also present parallel results for the final best model illustrated in Figure 2 (model 5 in Table 5). The first ten rows present results of the hypothesis testing. Path coefficients and their respective Z-statistics and indications of significance are summarized for each hypothesis. The next two rows present results for the paths added during the testing of the next-best unconstrained model. The last 25 rows present control paths with path coefficients, Z-statistics, and indications of significance. From the top ten rows of Table 5, we note that all ten hypothesized relationships are in the direction expected in model 2. Seven out of ten relationships were statistically significant at conventional levels ($p < .05$). Two more relationships were statistically significant at marginal levels ($p < .10$). As illustrated in Table 5, the results remained stable for models 2 and 5.

TABLE 5
Structural Equations Modeling Results Comparing Hypothesis Tests for the Theoretical and Final Models

			Model 2		Model 5	
Hypothesis	Description of Path	Hypothesized Direction	Path Coefficient	Z	Path Coefficient	Z
1	Acquisition intensity → divestiture intensity	+	.110†	1.718	.111†	1.724
2	Acquisition intensity → internal innovation	–	–.167**	–3.141	–.164**	–3.010
3	Acquisition intensity → strategic controls	–	–.181*	–2.310	–.181*	2.317
4	Acquisition intensity → financial controls	+	.179*	2.133	.216*	2.514
5	Divestiture intensity → internal innovation	–	–.016	–0.326		
6	Divestiture intensity → financial controls	+	.145†	1.802	.149†	1.834
7	Divestiture intensity → strategic controls	–	–.158*	–2.037	–.159*	–2.055
8	Strategic controls → internal innovation	+	.195***	3.764	.224***	4.015
9	Financial controls → internal innovation	–	–.194**	–3.166	–.219***	–3.300
10	Financial controls → external innovation	+	.304**	3.036	.262**	2.716
Added path[a]	Acquisition intensity → external innovation	+			.235**	2.797
Added path[a]	Strategic controls → financial controls	–			.297***	3.291
Control	Product diversification → internal innovation		–.150*	–1.961	–.152*	–1.989
Control	Firm size → internal innovation		–.379***	–5.608	–.393***	–5.855
Control	Industry R&D intensity → internal innovation		.143*	2.201	.141*	2.128
Control	Firm performance → internal innovation		–.038	–0.728	–.034	–0.665
Control	Current ratio → internal innovation		.154**	2.632	.151*	2.557
Control	Product diversification → external innovation		.096	1.109	.045	0.527
Control	Firm size → external innovation		.012	0.117	–.055	–0.554
Control	Industry R&D intensity → external innovation		.143†	1.756	.138†	1.723
Control	Firm performance → external innovation		.174*	2.101	.183*	2.254
Control	Current ratio → external innovation		.015	0.171	.015	0.173
Control	Product diversification → strategic controls		–.045	–0.532	–.044	–0.526
Control	Firm size → strategic controls		.302**	3.009	.304**	3.034
Control	Industry R&D intensity → strategic controls		.141†	1.844	.143†	1.859
Control	Firm performance → strategic controls		–.079	–0.996	–.080	–1.005
Control	Current ratio → strategic controls		.084	0.989	.084	0.989
Control	Product diversification → financial controls		.102	1.128	.091	1.044
Control	Firm size → financial controls		–.026	–0.248	–.123	–1.167
Control	Industry R&D intensity → financial controls		–.169*	–2.044	–.214*	–2.563
Control	Firm performance → financial controls		.022	0.268	.004	0.052
Control	Current ratio → financial controls		–.025	–0.290	–.059	–0.676
Control	Product diversification → divestiture intensity		.184*	2.463	.182*	2.459
Control	Firm size → divestiture intensity		.198*	2.386	.199*	2.402
Control	Industry R&D intensity → divestiture intensity		–.072	–1.139	–.073	–1.146
Control	Firm performance → divestiture intensity		–.187**	–2.830	–.188**	–2.832
Control	Current ratio → divestiture intensity		–.038	–0.544	–.038	–0.546

[a] These paths were hypothesized in the next-best unconstrained model (model 4).

† $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

Results of Hypothesis Tests

Acquisition intensity hypotheses. Acquisition intensity is positively related to divestiture intensity (.111, $p < .10$). Thus, Hypothesis 1 received support. Hypothesis 2 also received support. Acquisition intensity has a statistically significant, negative effect on internal innovation (–.164, $p < .01$). Additionally, acquistion intensity has a significant, negative effect on strategic control use, supporting Hypothesis 3 (–.181, $p < .05$). Lastly, acquisition intensity is positively related to financial controls (.216, $p < .05$). Hypothesis 4 therefore received support.

Divestiture intensity hypotheses. Hypothesis 5 was not supported. There was no statistically significant relationship between divestiture intensity and internal innovation (–.016, n.s.). Hypothesis 6 received support. Divestiture intensity had a statistically significant effect on use of financial controls (.149, $p < .10$). Alternatively, divestiture intensity exhibited a negative relationship with use of strategic controls (–.159, $p < .05$). Thus, Hypothesis 7 received support.

Control system hypotheses. Strategic controls were found to be positively related to internal innovation (.224, $p < .001$), providing support for Hypothesis 8. Hypothesis 9 also received support. Financial controls exhibited a statistically significant, negative relationship with internal innovation (–.219, $p < .001$). Lastly, financial controls were positively related to external innovation (.262, $p < .01$), providing support for Hypothesis 10.

Other Results

Special paths in the final model. Table 5 presents two special paths that were added during model respecification (in the next-best unconstrained model, model 4). Because we did not initially hypothesize these paths, no path coefficients or Z-statistics are available from the theoretical model (model 2). Two of the three added paths are statistically significant. In the first added path, a positive relationship between acquisition intensity and external innovation was predicted. The path coefficient was positive and statistically significant (.235, $p < .01$). In the second added path, the relationship between strategic controls and financial controls was predicted to be negative. However, the path coefficient was positive and statistically significant (.297, $p < .001$). The third path, between strategic controls and external innovation, was not statistically significant.

Control variables. There were 25 paths between control variables and the primary theoretical variables in the model. Table 5 depicts these paths, 12 of which were statistically significant. It is of note that firm size was positively related to strategic controls (.304, $p < .01$) but negatively related to internal innovation (–.393, $p < .001$). Other relatively strong relationships included the path from firm performance to divestiture intensity (–.188, $p < .01$) and that from industry R&D intensity to financial controls (–.214, $p < .05$). These relationships were as we expected on the basis of prior research.

DISCUSSION

The research provided strong support for the general model presented in Figure 1. In fact, nine of the ten hypotheses received support from the results of the study. These results strongly suggest that firms actively buying or selling businesses, or both, are likely to produce less internal innovation and rely more heavily on external innovation for a variety of reasons, including the structure and implementation of the internal control systems derived from their strategic actions.

The results have important implications for the fields of strategic management and organization theory. First, innovation is an important outcome of firm processes and has been shown to be critical for firm performance, particularly in industries with global competition (Franko, 1989). Bettis and Hitt (1995) described a new competitive landscape that is developing because of the increasing global competition and the technological revolution that affect most all organizations. This new competitive landscape places importance on firms being able to innovate in order to remain competitive in global markets. Innovation is important in both new product introductions and the processing of information and communications throughout complex organizations with operations in multiple countries.

This study focused on strategic actions that have been popular for many years, exemplified by the more than 55,000 acquisitions that occurred during the 1980s, followed by the significant restructuring (downscoping and downsizing) of many major corporations in the United States and abroad (Hitt, Keats, Harback, & Nixon, 1994). Recent data suggest the potential for a new wave of mergers and acquisitions on a global basis. Given that innovation is important for strategic competitiveness and that the buying and selling of businesses is becoming a globally popular strategic action, our results are profoundly important.

Our results suggest that an active acquisition strategy has direct, negative effects on the internal development of firm innovation. This effect is likely due to the transaction costs involved and to acquisition-related activities that absorb managers' time and energy. Because of these transaction costs, managers have little time left to manage other important projects, and target firm managers in particular become strongly risk averse. Thus, managers of acquiring and target firms may postpone major decisions regarding long-term investments such as R&D and thereby reduce the innovative capabilities of their firms.

Acquisitions also have indirect effects on the internal innovation of a firm through the control systems used to implement this strategy. As a firm acquires new units, top corporate executives' span of control increases, and their need to process information grows. Their information-processing capacities become strained, and they often change from an emphasis on strategic controls to an emphasis on financial controls. This change is important because our results show that strategic controls have a positive effect on internal innovation, but financial controls have a negative effect on it. Financial controls establish financial targets whereby division managers become increasingly oriented toward the short term and reduce investments (e.g., in new product development) that will not pay off except in the long term.

Alternatively, firms following an active acquisition strategy may remain innovative by acquiring firms that have produced innovations. In other words, they may seek firms that have recently introduced new products or processes in order to remain competitive in their markets. This finding is interesting and suggests how acquiring firms, such as General Electric, can remain competitive while producing less internal innovation. However, Goodman and Lawless (1994) argued that although the acquisition of external innovation may aid a firm's competitive position, it simultaneously lessens corporate control over strategic results. Also, as these acquiring firms integrate the newly acquired innovative business into their organizations and apply the same set of control systems, the new business is likely to become less innovative over time.

These problems are dramatically shown by Smucker's acquisition of Mrs. Smith's. Smucker's faced challenges from competitors that introduced new products to the market, and it turned to acquisitions for new products and sales and profit growth. One of Mrs. Smith's new product lines, SmartStyle lower-calorie desserts, which was introduced with a costly promotional campaign, failed after the acquisition and had to be withdrawn from the market. This failure hurt Smucker's financial performance. One analyst suggested that Smucker's past risk aversion had hurt its competitiveness in the marketplace. Moreover, this analyst predicted that the firm's future was based on its ability to leverage new products through acquisitions (Murray, 1995). More research is required to understand the nature of external innovation and its effects on long-term firm performance.

Jensen (1993) argued that firms that are spending too much on R&D (i.e., the R&D is not producing adequate returns for investors) may be targeted for acquisition. However, the appropriate level of investment in R&D may be difficult to identify. The recent example of Chrysler Corporation provides a case in point. Kirk Kerkorian, a large Chrysler shareholder, made a tender offer for Chrysler Corporation, in partnership with Lee Iaccoca, the former CEO. In particular, Kerkorian felt that Chrysler had excessive cash reserves that should be distributed in dividends to shareholders. However, corporate executives argued that the high cash reserves were necessary to sustain the future new product development required in a globally competitive environment. In this case, the market sided with Chrysler managers, and Kerkorian's proposal did not receive the financial support it needed to move ahead (Woodruff, Laderman, Spiro, Kerwin, & Treece, 1995).

Our results regarding active divestitures provide finer-grained information than previous research and thereby have important differences. For example, Hoskisson and Johnson (1992) suggested that restructuring firms (those actively divesting units) might be able to reestablish strategic controls and thereby improve their innovation (although they did not measure strategic controls). Our results suggest that firms that are actively divesting businesses cannot reinstate strategic controls while they are restructuring. The process of divestiture also creates significant transaction costs, similar to those acquiring firms incur. Additionally, these actively divesting firms are undergoing significant transformations, so managers may be experiencing significant chaos. Thus, to maintain some order and control, firms making significant divestitures are likely to maintain or even heighten financial controls.

Alternatively, no relationship was found between divestiture intensity and internal innovation. These results suggest that the major effects of divestitures on innovation are indirect, mediated by control systems. Some of the firms making divestitures are likely doing so as a part of a well-planned program of downscoping (Hoskisson & Hitt, 1994). Although such firms may desire to change their control systems, the turmoil (and even chaos) created by the major changes do not allow them to do so. However, the goals of the divestiture program may be to refocus the firm and, in the process, increase firm innovation. Thus, the countervailing forces of positive goals and negative effects from the emphasis on financial controls produce neutral effects of divestitures on internal innovation. In our data set were 36 firms that had completed their divestiture program (they had made no divestitures in the most recent two-year period). These firms, for this reason, were not included in the sample for our primary hypothesis tests. However, post hoc analyses showed divestiture intensity in these firms to have a positive and significant effect on internal innovation. These results provide support for prior research (Hoskisson & Johnson, 1992) and for the arguments regarding the goals of divestitures stated above.

The results of this study strongly suggest that the least innovative firms are likely those following a portfolio strategy. Those firms are regularly acquiring and divesting businesses, so the effects on control systems, internal innovation, and external innovation are likely to be magnified. Because of the continuous changes in the portfolio of businesses through acquisitions and divestitures, these firms have strong financial controls and use few, if any, strategic controls. Furthermore, even if they acquire innovative businesses, they are less likely to realize advantages from them because of the strong focus on acquisitions and divestitures (significant transaction costs and use of managerial time and energy) and heavy emphasis on financial controls. Thus, a portfolio strategy is likely to be successful only in industries in which innovation is unimportant (e.g., mature industries where increases in internal efficiencies can produce greater returns).

The results of this study provide guidance for future research. The significance of internal controls in our study strongly suggests that control systems should be examined in research on organizational innovation. Additionally, we need a better understanding of the long-term implications of substituting external for internal innovation. The research reported herein also suggests that research on organizational innovation should examine systemic integrated models (as opposed to simple bivariate relationships).

More research is also required to understand the true relationship between strategic and financial controls. The results of our study suggest a positive relationship between the two. Perhaps strong use of strategic controls allows positive use of financial controls and delimits their negative effects on organizations.

This research has provided a finer-grained examination of the effects of buying and selling businesses on firm innovation than done in previous research. Specifically, this study has several features not included in previous studies. These include the simultaneous examination of acquisition and divestiture intensity, examination of the relationships between internal control systems and acquisition and divestiture intensity as well as internal and external innovation, examination of both R&D investments and the introduction of new products (internal innovation), and examination of acquiring innovation externally. Perhaps the greatest contribution, however, is that these relationships were examined in a holistic, integrated model for the first time. Although acquisitions seem to have both a direct and mediated effect on firm innovation, divestitures' effect on firm innovation is more indirect, mediated through the firm's control system (until the program of divestitures is completed).

This research suggests that active involvement in the market for corporate control can be negative to an organization's health in industries in which innovation is important. Furthermore, because of the growing importance of innovation in the developing new competitive landscape and the increasing global activity in mergers and acquisitions, the findings of this study may be critically important for firms' maintenance of strategic competitiveness. We conclude that the context in which innovation is framed is strongly affected both by top management's engagement in the market for corporate control and by the effects of that engagement on the control mechanisms used and the design and process of innovation in the organizational units most responsible for innovation.

In conclusion, this research has added to both the strategic management and organization theory literatures focused on acquisitions, restructuring, and organizational innovation. Activity in the market for corporate control can have potentially positive and negative effects, and managers need to understand those effects and their meaning for long-term firm competitiveness and performance. The amount and timing of organizational innovation is becoming increasingly important (Damanpour, 1991; Eisenhardt & Schoonhoven, 1990). Thus, there is a need to understand how strategies undertaken by top executives may affect firms' ability to be innovative, even though those strategies are not designed to affect the firm's innovativeness. Research has shown that firms can be active acquirers and still remain innovative (Hitt, Harrison, Ireland, & Best, 1995). However, it requires a conscious strategic emphasis on innovation and careful selection of target firms for the goals of acquisition and firm innovation to be simultaneously achieved. Therefore, the results of this study may have critical implications for firms competing in the global marketplace.

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SUSTAINED PRODUCT INNOVATION IN LARGE, MATURE ORGANIZATIONS: OVERCOMING INNOVATION-TO-ORGANIZATION PROBLEMS

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We examined problems with sustained product innovation in 15 firms that averaged 96 years of age, 54,000 employees, and $9.4 billion in annual revenues. Findings reveal that the inability to connect new products with organizational resources, processes, and strategy thwarted innovation in these large, mature organizations and that innovators lacked the power to make these connections. We suggest that these organizations must reconfigure their systems of power to become capable of sustained innovation and offer recommendations for practice.

Successful new products and services are critical for many organizations, since product innovation is one important way that organizations can adapt to changes in markets, technology, and competition. There is, accordingly, a large and growing literature on product innovation, at the level of both specific projects (Cooper, 1983; Zirger & Maidique, 1990) and the organization as a whole (Nevens, Summe, & Uttal, 1990; Wheelright & Clark, 1992). Researchers have identified organizational characteristics that relate to successful product innovation, such as organizational configurations (Burns & Stalker, 1961; Mintzberg, 1979a), culture (Kanter, 1983), strategy (Day, 1990), leadership (Quinn, 1985), and various combinations of these (Jelinek & Schoonhoven, 1990; Roberts, 1988; Van de Ven, 1986). Although many details remain to be articulated, this work has produced a good understanding of the innovative organization, at least as an ideal type.

However, many organizations still have difficulty with sustained product innovation, or managing a number of product innovations over time (Arthur D. Little, 1991). Sustained product innovation is particularly difficult for organizations with long histories of stable operations. Hage (1988) argued that long-stable organizations are especially challenged by changes in technology and global competition: they must become more innovative if they are to survive, but to do so they must fundamentally change how they organize.

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This research seeks to extend theory on organizing for innovation by focusing on (1) sustained product innovation and (2) organizations with histories of stable, noninnovative practices that are struggling to become innovative. We define sustained product innovation as the generation of multiple new products, as strategically necessary over time, with a reasonable rate of commercial success. We define new products as those (1) intended for customers who are unfamiliar to an organization or (2) that require unfamiliar product or process technologies. Most organizations can produce a successful new product occasionally—IBM's PC and General Motors' Saturn are good examples. The question is whether they can sustain or repeat what they did. Peters (1992) described the introduction of a successful new product by a 120-year-old machinery manufacturer but wondered if the organization could replicate that success. Dougherty and Cohen (1995) visited the firm several years later to discover that all subsequent new product efforts had failed, because of a lack of the organization-wide change needed to accommodate multiple product innovation efforts. Many large, mature organizations must become capable of sustained product innovation for competitive reasons. However, most ideas for organizing for innovation come from already innovative firms (e.g., Clark & Fujimoto, 1991; Nevens et al., 1990). Although informative, these insights do not reveal enough about the barriers that noninnovative firms must deal with to become innovative.

To explore the problems with sustained product innovation in large, mature firms, we examined 40 product/service innovations in 15 very large firms. We found that most of these firms were not organized to facilitate innovation: occasionally innovation did occur, but it occurred in spite of the system, not because of it. We also found that product innovation is a fragile and vulnerable activity. We develop new theory to explain why inability to sustain product innovation is so deeply engrained in these large, mature organizations and to identify the organization-wide changes that must be made before they can become consistently innovative over time.

INNOVATION PROBLEMS

Two levels of problems are associated with innovation: those affecting a particular project and those affecting the organizational context. At the level of the particular product, problems include positioning the product strategically in the market, developing production, marketing, and sales, securing expertise, managing external relations (Kazanjian, 1988), understanding new markets (Cooper, 1983; Leonard-Barton, 1991), forming multifunctional teams and sharing knowledge (Ancona & Caldwell, 1990; Dougherty, 1992), and evaluating progress (Griffin & Page, 1993). When project-level problems are resolved across multiple innovations and multiple stages simultaneously, sustained innovation can occur. Such problem solving occurs at the organizational level. According to Sykes, "Successful new ventures usually focus on a single product. Successful mature corporations must learn to manage the complexities of multiple products, [making] older products obsolete" (1986: 74).

The challenge of connecting innovations with routine operations has long been noted (Burns & Stalker, 1961; Kanter, 1983). Structures and strategies in mature organizations reinforce existing practices and, according to Hlavacek and Thompson (1973), are "hostile to creativity" (Burgelman, 1983; Dougherty, 1990; Meyer, 1982). The inertia of current practice can overwhelm concerted efforts to change (Hannan & Freeman, 1984; Johnson, 1988). One solution is to put new products into separate venture units (Hlavacek & Thompson, 1973; Galbraith, 1982). Unfortunately, new products are inextricably bound up with the rest of an organization, so avoiding the connections is not a real solution. Fast (1978) found that new product ventures failed because they no longer fit with a corporation's strategic posture, or their political positions eroded so they were rejected by the existing power structure. In a postmortem of Exxon's venture division, Sykes (1986) also found that the failure to connect internal ventures to mainstream operations was central to the division's demise.

The literature suggests that for a mature organization to develop the capacity for sustained innovation, it must successfully make these innovation-to-organization connections in three key areas: (1) make resources available for new products, (2) provide collaborative structures and processes to solve problems creatively and connect innovations with existing businesses, and (3) incorporate innovation as a meaningful component of the organization's strategy. These three categories are not exhaustive, but they do focus attention on important organization-level problem areas. We briefly describe how these three connections can be made in ideal terms, and then suggest why they remain problematic for mature organizations.

Resources

An organization with both innovation projects and mature businesses ideally will have a resource system that channels money, equipment, expertise, and information to all these activities simultaneously. This resource system should also nurture new ideas and continuously raise and solve problems (Kanter, 1983). These resources should not rely on the availability of slack (extra padding, or a looseness in normal practice; Singh, 1986); rather, they should be deliberately distributed to foster innovation. Pockets of seed money should exist throughout the organization so that ideas have multiple chances for development (Jelinek & Schoonhoven, 1990). Market and customer information should flow throughout (Moorman, 1995), and innovators should be able to access necessary expertise from all functions to resolve design and manufacturing problems and to test ideas against market and operating constraints (Dougherty, 1992; Souder, 1987). Major resource systems like manufacturing facilities and sales channels should be specifically designed so that new products can be included readily (Wheelright & Clark, 1992).

Unfortunately, resources do not always flow smoothly to innovation, particularly where prevailing practice supports established activities (e.g., Henderson & Clark, 1990). Many writers have suggested the use of product champions and networks of entrepreneurial roles and relationships to facilitate the flow of resources to innovations (Ancona & Caldwell, 1990; Maidique, 1980; Roberts, 1988; Schon, 1963). However, in large, mature organizations champions may be too busy keeping an idea alive to generate adequate managerial and budgetary support, as Burgelman (1983) found in a case study of innovation in a chemicals firm. A new product project may not connect with supporting assets unless someone with substantial power steps in to strengthen its position, as Day (1994) found in a large survey of established firms.

Collaborative Structures and Processes

Each innovation project also needs administrative structures and processes appropriate to its development stage and access to decision making across the organization. An organization should have structures and processes designed to make decisions continually, to follow through on problems, and to bring new issues to the ongoing agenda (Jelinek & Schoonhoven 1990). Multifunctional teams should be put in place early on for each innovation, and committees and task forces should work through technical problems faced by multiple projects and incorporate all the new products into the organization's structure and processes (Van de Ven, 1986; Wheelwright & Clark, 1992). These collaborative structures and problem-solving processes should connect laterally and vertically, so that people throughout the organization can participate in selecting, defining, and refining innovations across functions, product lines, and divisions (Kanter, 1983, 1988; Quinn, 1985). Regular operations reviews should be held to raise issues, renegotiate targets, and assure disciplined follow-up so that people deliver on promised goals (Brock & Macmillan, 1993; Jelinek & Schoonhoven, 1990).

Unfortunately, structures and processes in mature organizations are often not designed for organization-wide collaboration and problem solving. Instead, a segmentalist orientation exists, leading managers to break tasks down and then assign them to separate units (Hlavacek & Thompson, 1973; Kanter, 1983). The reward system punishes people for stepping out of established work roles, as Quelch, Farris, and Olver (1987) found in a sample of packaged goods firms. Certain departments dominate the innovation process despite the existence of formal multifunctional teams and committees, as Workman (1993) found in a large computer manufacturer. Organizational routines limit interfunctional interaction and inhibit the development of customer understanding, as Dougherty (1990) found in five mature firms.

Strategic Value and Meaning

Finally, innovators must tap into existing competencies and assets if they are to build on know-how, take advantage of unique resources, and create new competencies (Day, 1994; Leonard-Barton, 1992). These assets and their supporting processes should themselves change to accommodate new products so, ideally, innovations and the organization mutually "constitute" one another over time (Leonard-Barton, 1988). Van de Ven (1986) called this connection the parts-whole relation, and Kanter (1988) called it managing institutional relations: ideally, an organization's strategy explicitly values innovation, openly welcomes initiative, and clearly rewards those who successfully resolve problems. The constituent activities of innovation (such as understanding markets and tracking technological change) should be understood as appropriate activities for all organization members (Dougherty, 1992). Senior managers should set the strategic direction but involve people well down in the organizational hierarchy to solve problems and to create assessment criteria (Quinn, 1985). Involvement helps people understand their part in the innovation process and creates a shared responsibility for success (Jelinek & Schoonhoven, 1990). Involvement also legitimates the role of middle managers in setting the strategic agenda, which in turn energizes them (Westley, 1990).

Unfortunately, innovations are often excluded from an organization's strategy and are not part of senior management's agenda (Burgelman, 1983). Studies show a correlation between a lack of strategic connection and innovation failure (e.g., Cooper & Kleinschmidt, 1987). Dougherty and Heller (1994) found that the activities of product innovation were illegitimate in large, mature firms, either violating prevailing norms or falling into a vacuum; no shared understanding existed to make them meaningful. Successful innovators reframed prevailing patterns of thinking and acting to incorporate their new products; however, this reframing only embraced those particular products. Looking at the same data, Frost (1994) argued that reframing needs an atmosphere of trust to allow people to experiment with different ways of seeing things. What was missing in the organizations studied by Dougherty and Heller was, he suggested, the ability to create meaning for new products that enabled others to understand them.

This brief review of organization-level problems with resource acquisition, collaboration, and strategic meaning and value indicates that large, mature organizations often privilege existing businesses over new products, avoid uncertainty in favor of the tried and true, and emphasize control over flexibility and creativity. Although these problems are not new (cf. March & Simon, 1958), our purpose is to understand why organizations that are attempting to become more innovative still fall prey to them. Why can't they connect product innovations with their resources, structures, and strategies effectively? By answering these questions, we can understand why and how these problems persist, and suggest how organizations can resolve them.

METHODS

We used in-depth interviews with 134 innovators in 15 large, mature organizations to explore whether and how resources flowed to innovation projects, whether and how structures connected the innovations to ongoing work in other functions, divisions, and managerial levels, and whether and how innovation projects became embodied in the organizations' strategies. As noted, firms averaged 96 years of age, 54,000 employees, and $9.4 billion (U.S.) in annual revenue: these are very large, very mature organizations. All had dominated at least several niches in their markets for decades but, at the time of the study, faced heightened competition and technological change, which, according to senior managers we interviewed, altered the nature of their businesses and pushed them to rethink the manner in which they worked.

Table 1 summarizes the 15 firms in the study. Four are in different sectors of the chemicals industry, 2 are in consumer packaged goods, and the rest are in various industrial and service industries. The variety of industry types assures that the findings do not relate only to specific industries. The firms were also undergoing different degrees of change when the interviews were held. Some were in the midst of major downsizings or mergers, and others were relatively stable. The firms also varied on their experiences with innovation: some had been trying to be more innovative for several years; others were just beginning. Thirteen were headquartered in the United States, 1 in Canada, and 1 in the United Kingdom. By agreement with the participants, none of the firms can be identified, so Table 1 presents the years since founding and total revenues in multiples of ten. Only 2 organizations had been founded less than 50 years ago, and only 2 generated less than $1 billion in annual revenue. We interviewed six or more people in 12 of the 15 firms and learned about at least two different kinds of product efforts in all but 1 of them.

Within these 15 organizations, we selected 40 cases of new product development[1] for in-depth study. All the new products were intended for unfamiliar markets or used unfamiliar technologies, and all were either still under development or had recently been canceled. All had been officially approved by senior management. To learn about each case, we interviewed people who worked directly on the project. We interviewed participants from different departments in all but 5 of the 40 cases, where we had access to only one participant. (In another 3 cases, only one person was involved in the product.) Interviewees averaged nine years of tenure within their firms and came from the sales, engineering, manufacturing, marketing, and accounting functions.

The interviews focused on people's understandings of a new product's development, including its connection with the organization's resources, structures and processes, and strategy. All the interviews followed a common protocol: we initially asked people to tell the story of the product so that they would not feel constrained by inappropriate or irrelevant questions. As the interviews progressed, we asked more specific questions, asking people to describe what they knew about the market and technology and how they

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[1] For the sake of simplicity, we use the term "new products" to refer to all cases, even though some of the products did not get out into the market.

TABLE 1
Summary of Firms in Study

Firms and Principal Products	Industry	Firm Age in Years	Firm Size: Annual Revenue[a]	Number of People Interviewed	Number of Innovation Projects Studied	Status of Projects after 2-Year Follow-Up
FLOWCO Chemicals used in industrial processing	Chemicals	>80	>$5	8	3	2 in development; 1 in market, status unclear
CHEMCO Chemicals from commodities to plastics, and equipment	Chemicals	>120	>$20	16	4	1 success; 2 in market, status unclear; 1 canceled
LUBECO Specialty chemicals for industrial processing	Chemicals	>70	<$1	7	3	2 in development; 1 failed
UTILCO Industrial gases	Chemicals	>90	>$10	7	2	2 in market, status unclear
FOODCO Consumer food products, packaged goods	Packaged goods	>60	>$20	8	2	1 success; 1 in market, status unclear
PACKCO Consumer food products, packaged goods	Packaged goods	>60	>$5	15	2	1 success; 1 canceled
PAPCO Paper products and office supplies	Paper	>90	>$5	10	3	3 in market, status unclear
BUILDCO Building products, supplies for industrial and residential uses	Building products	>80	>$10	6	2	2 in development
MACHCO Industrial machinery and equipment	Machinery	>70	>$10	10	4	1 in market, status unclear; 1 in development; 1 canceled; 1 failed

TABLE 1 (continued)

Firms and Principal Products	Industry	Firm Age in Years	Firm Size: Annual Revenue[a]	Number of People Interviewed	Number of Innovation Projects Studied	Status of Projects after 2-Year Follow-Up
DOCCO						
Office equipment	Office equipment	>30	>$10	4	3	1 success; 2 in development
INFOCO						
Computers	Computers	>100	>$20	2	1	1 in development
OPCO						
Telephone operations	Telephone	>100	>$10	6	2	1 in market, status unclear; 1 canceled
DATCO						
Financial reports, industry summaries	Information service	>80	>$10	4	3	2 in market, status unclear; 1 in development
BANKCO						
Banking services, bonds	Finance	>30	<$2	16	4	1 success; 1 in market, status unclear; 1 in development; 1 failed
CONSCO						
Engineering consulting	Consulting	>50	<$1	11	2	2 in market, status unclear

[a] In billions of U.S. dollars.

TABLE 2
New Product Cases by Current Status and Innovativeness[a]

Innovativeness[b]	Success	In Market, Status Not Clear	In Development	Canceled In Development	Failed
Low					
Unfamiliar in one or two ways	Bond (3) Food item (7) Document system (2)	Bond (8) Information package (2)	Bond (1) Information package (1)		Bond (4)
Medium					
Unfamiliar in three ways	Food item (3) Chemical (4)	Rock crusher (2) Document system (5) Office product (4) Chemical (2) Chemical (3) Information package (1) Food item (5) Chemical (3) Communication system (4) Plastic (6)	Specialty chemical (1) Lubricant (3) Building product (1) Machine (4) Solvent (4) Office machine (1)		Specialty chemical (3)
High					
Unfamiliar in four or five ways		Medical system (2) Expert system (4) Expert system (7) Warehouse system (1)	Medical product (3) Computing system (2) Robot (5) Office machine (1)	Communication system (2) Site management system (2) Waste remediation (4) Food item (10)	Operating system (4)

[a] The numbers in parentheses indicate the number of individuals interviewed for a project. The 5 successful products come from 5 different firms; the 16 in-market products, from 10 different firms; the 12 in-development products, from 8 different firms; the 4 canceled products, from 4 different firms; and the 3 failed products, from 3 different firms. The status of the cases is therefore not a result of firm affiliation.

[b] The five ways in which a product could be innovative were new users, new uses, new product technology, new manufacturing, new distribution.

got the necessary resources, how they worked with other departments and divisions, and whether the firm had helped or hindered the innovation. Eleven people described products that had already been canceled, and 123 described products still in development. To capture insight into changes over time, we conducted 98 follow-up interviews two years after the first round. We used these follow-up interviews to establish the commercial status of the products that had not already failed at the time of the first interview. In the first round, most people presented their innovation as a winner, but two years later we found only five clear successes.

Table 2 gives the number of people interviewed for each product and the product's degree of innovativeness and commercial success at the time of the follow-up. Of the 37 products that did not fail, 5 were commercially successful, 16 were in the market but their fate was uncertain, 12 were still in development, and 4 had been canceled.

The data set is notable for its size and richness. Since our focus was on sustained innovation and large, mature firms, we deliberately developed a theoretical sample (rather than a random one) that includes only firms with long histories of stable practices to gain a rich, in-depth look at this type of organizational context. Even the computer manufacturer in our sample had roots going back more than 100 years, and the rather young banking firm had been in a very regulated portion of that industry for all of its history. The 40 new products also varied so we could compare the experiences of those working on different kinds of innovations.

The data set obviously has limitations. These firms do not represent all large, old firms, or all firms in their industries, and these cases do not represent the population of product innovations. We view the connection between the innovations and the organizations only through the descriptions of those who worked on the innovations and do not have the insights of functional and senior managers. These limits impose constraints on the interpretation of results and suggest interesting topics for subsequent research; both issues are taken up in the Discussion section.

DATA ANALYSIS

Qualitative researchers generally use two approaches to data analysis: an in-depth analysis of data to uncover key themes, and an analysis of how strongly the proposed themes feature in the data (Miles & Huberman, 1984; Sutton & Callahan, 1987). We used both and added an initial overview because our data set was so large.

Overview

We began with a description of the extent to which the innovators we interviewed accessed resources, worked collaboratively across the organization, and developed the strategic meaning of their projects. First we categorized the problems discussed in all 134 interviews into one of those three areas of connection (resources, collaboration, and strategic meaning), and into a level (within-project or project-to-organization). Next, we coded the problems as solved or not solved (see the Appendix for details on codes and coding procedures). Within-project problems concerned issues that could be resolved within or by a product's team, such as working with people from another function (e.g., getting the "guys in the warehouse" to insert extra material) and defining a product to fit the targeted market. Project-to-organization problems involved reaching across major organizational boundaries, such as working with another business unit and determining whether a product fit the company's strategy.

These problems are normal in the sense that they can be expected to arise during most innovations. Previous research suggested that people in all types of innovations described roughly the same number of problems, so the quantity of problems per se did not distinguish success from failure (Dougherty & Heller, 1994). Rather, the key to effectiveness appeared to be problem solution. Figure 1 compares the average proportions of problems solved by the successful innovators and the others.[2] Successful innovators solved an average of 57 percent of their problems, and others solved only 37 percent.[3] We infer that the proportion of problems solved indicates more effective innovation.

Our concern was not with the success or failure of individual cases but with whether organizations could sustain innovation continuously. Thus, we compared the proportion of problems that were solved for all three areas of connection at both the within-project and project-to-organization levels. As Figure 2 indicates, successful innovators solved a much higher proportion of problems at the within-project level than the other innovators: they acquired more resources, more often built effective interfunctional teams, and conceptualized their products more thoroughly. However, successful innovators did not solve more project-to-organization level problems,[4] indi-

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[2] Inductive research should use exploratory data analysis techniques such as boxplots, because no hypothesis tests or random data are involved. We used inferential statistics instead, but only as a shorthand way to compare and contrast various groups in our data. The probability that the groups are different provides some, albeit indirect, insight into the variation around the means for the groups.

[3] We excluded the innovators involved with already-failed products from all analyses. These people described very few solved problems, but since they were the only ones in the data set who were looking back, their reports may have been biased. If they were included, the differences in rate of solution between the successful innovators and others would be larger but, we think, inflated. The first bar of Figure 1 excludes the failed innovators. The second bar of Figure 1 excludes innovators working on very innovative products and those in the early stages of development, since the successful category contained no cases with these attributes, and people in both these groups had lower solution rates. Again, we see that the successful innovators still solved more problems (57% vs. 39%), so degree of innovativeness and stage of product development do not account for the difference. The third bar shows the figures from the first line averaged by case first, and they are virtually the same (55 percent solution for successes versus 35 percent for the others).

[4] When we control for innovators working on very innovative projects or those in early stages, the difference in the rate of solution of resource problems at the project level becomes

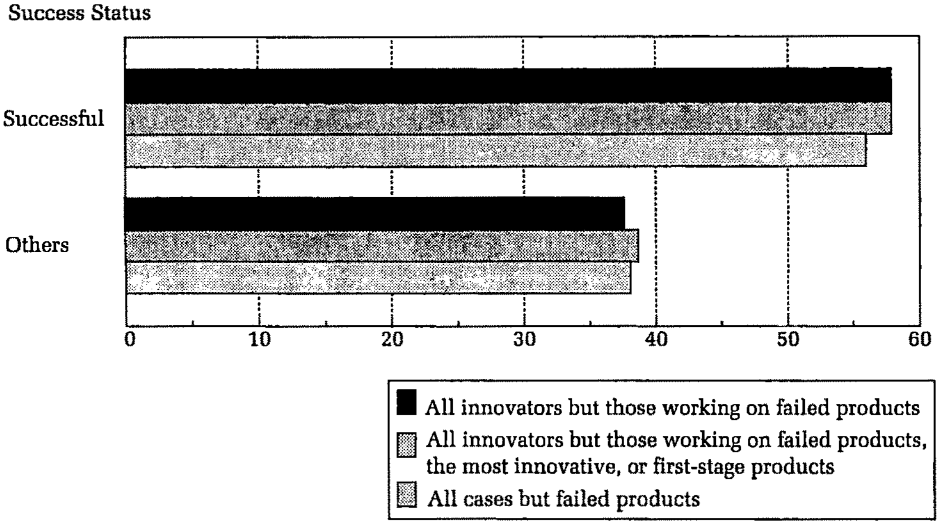

FIGURE 1
Proportion of Problems Solved by Project Success[a, b]

[a] One-tailed tests of the differences between successful cases and others are significant for the first two comparisons ($p = .004$, .02, and .13, respectively).

[b] For the three comparisons, $n = 16$ vs. 102, 16 vs. 54, and 5 vs. 32, respectively.

cating that all innovators had considerable difficulty establishing effective working relationships with senior managers, getting cooperation from other divisions, and improving risk-averse climates. Those innovators who had managed to get their new products effectively designed and launched had done so without organizational support.

The successful cases in our data illustrate the effects of limited organizational support on the ability to sustain innovation. In 3 of the 5 firms with successful cases, the special units that housed the new products were eliminated over the subsequent two years. In our follow-up interviews, people at these three firms said that management had shifted its attention to cost containment. For example, the marketing manager of a successful new product commented on FOODCO's shutdown of the new product unit:

> In the process of [a merger with another firm] there was a number of upper management changes which gave conflicting signals in regard to the viability of new products . . . the new regime is much more conservative and less willing to try new things.

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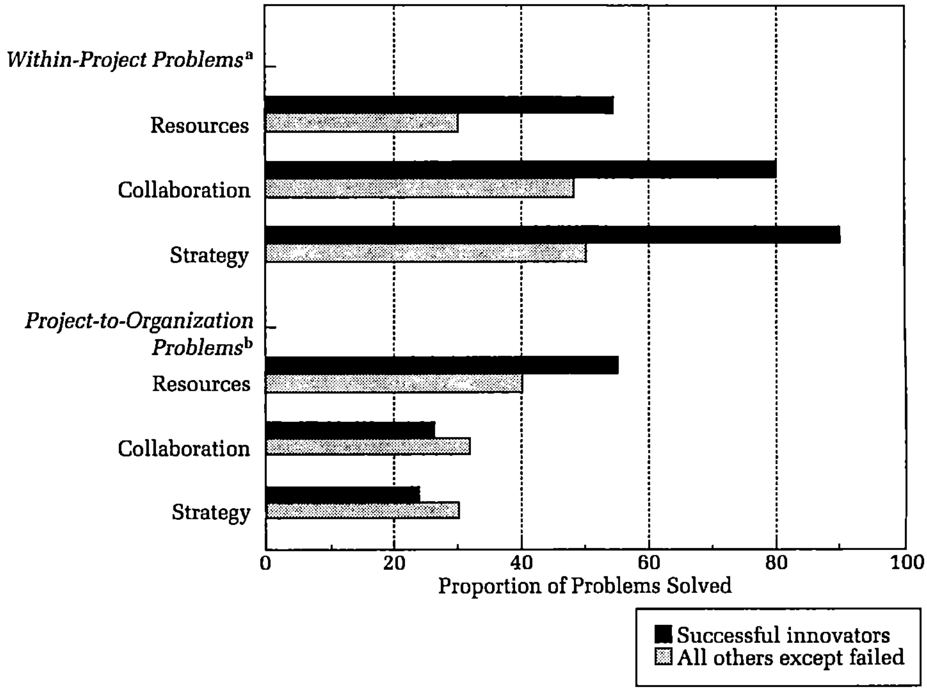
nonsignificant (the averages are 53 versus 39 percent instead of 32 percent). When we average the results by case first, this difference gets quite small (the other two project-level comparisons are still significantly different, even with case averages). It may be that getting resources at the project level was problematic as well, so this activity requires deeper examination.

FIGURE 2
Proportion of Problems Solved by Problem Level and Project Success



[a] One-tailed t-tests of differences in within-project problem solving are significant (p's range from .07 to .02).

[b] One-tailed t-tests show no significant differences in project-to-organization problem solving.

> Despite its success, this [multiple new product] process was a one-time-only endeavor.

Similarly, when one of us met the vice president for market research at PRODCO about two years later, he confirmed that the new products group in his firm had been closed as well, in favor of more conservative operations, although he had wanted the group to continue. What happened to the successful products lends support to our inference (developed more fully below) that product innovations occurred in spite of the organizations, not because of them, and were only occasional events rather than part of a sustained process.

In-Depth Analysis

Our next step developed a richer appreciation for why none of the innovation teams in our study readily showed project-to-organization connection problems. Following the methodology described by Bailyn (1977) and by Strauss (1987), we first examined a number of these problem descriptions in detail, to identify the underlying factors that made them so difficult. Mintzberg (1979b) refers to such an analysis as "detective work" designed to trace down patterns and consistencies. We thoroughly scrutinized interviews from several cases, writing out problems and how they were solved, if they were. We then examined problem descriptions from other interviews to revise and elaborate our initial ideas in light of this additional evidence. The interplay between the data and the emerging patterns continued until the patterns were refined into adequate conceptual categories (Bailyn, 1977; Eisenhardt, 1989a.) We do not assume that our findings perfectly match all products in our data set, or that we have considered every possible explanation. Our goal was to identify common themes, so we concentrated on common resource, collaboration, and strategic meaning issues among the cases (Sutton & Callahan, 1987; Van Maanen, 1983). Our themes fit with our data but, as is the case in quantitative research, not all of the variation is explained.

Before presenting illustrations from the product cases, we summarize our findings. First, we found that where individual innovation projects were successful, they depended on the efforts of particular individuals to use their organizational positions (e.g., Brass, 1984) to further and protect innovation efforts: they did not result from an organization-wide commitment to innovation. In the organizations in our study, innovation was not the responsibility of the organization as a whole. Sometimes individuals were able to resolve project-to-organization connection problems successfully by accessing resources, establishing collaborative processes, and creating strategic meaning for their innovation. But connections made in this way were fragile and vulnerable, because they depended on the initiatives of the incumbents of specific positions (usually in middle management) and their particular networks rather than on organization-wide systems. In any event, positions per se did not guarantee connections since they did not carry much weight in other divisions. Individuals also drew on their own networks and reputations, but often networks did not reach far enough to solve specific issues—for instance, a network might not enable an individual to get a particular sales force to carry a new product. Some innovators were either too new or had spent too much time in only one function to have networks in the first place. In fact, the prevailing organizational systems encouraged conformity and stability.

Second, innovators had only piecemeal access to the necessary resources, had limited structures and processes to work with, and faced tenuous strategic connections for innovation across their organizations. These findings are consistent with Fast's (1978). However, rather than conclude that the strategic support and political positions of the ventures eroded over time, as did Fast, we suggest that innovations never had strategic support or power in the first place. Innovation had little positive, strategic meaning in these organizations. Innovators could rarely get people in different functions, divisions, or hierarchical levels to comprehend their role in making innovation happen. People not directly involved with an innovation did not seem to know what they should do to help out, or even that they should help out. Innovation was not simply suppressed, it was unseen; it was ignored and invisible in a wider organizational community that could not understand its role.

Third, we infer that strategic support from senior management was nonexistent or only temporary. Except for one company, we found no attempt to embed innovation into the decision premises, day-to-day web of understandings, and taken-for-granted rules that make activities meaningful (Drazin & Sandelands, 1992; Pettigrew, 1979). In most of the firms, senior managers made other concerns, such as mergers, performance pressures, or downsizing, more meaningful. Innovation was not only cut adrift, it was canceled. Consequently, successful innovation was merely a one-time event, not a sustained, continuous process supported by an organization-wide commitment.

We turned to a more systematic comparison to see if other attributes of the cases or firms explained differences in the proportion of problems solved, comparing two extreme subsets of cases—the 10 with the highest average proportion of project-to-organization problems solved and the 10 with the lowest average proportion of such problems solved. Table 3 shows this comparison. In the 10 cases with the most project-to-organization problems solved, the rate of solution ranges from 100 to 56 percent, and in the bottom 10 it ranges from 17 to 0 percent (8 have 0 percent). The table also lists additional attributes, such as each product's success status, degree of innovativeness, and company. The company may affect the extent of problem solving. Two of the cases in the top 10 are from DOCCO, which, interviews suggested, had developed a more systematic approach to managing innovation and resembled the ideal type. In addition, 3 of the bottom 10 cases come from BANKCO, which had only recently begun innovation attempts. With regard to the other attributes, however, the top and bottom 10 cases in Table 3 do not differ a great deal. On the basis of this comparison, we suggest that the problems described below are fairly well distributed across our data.

ILLUSTRATIONS OF KEY THEMES

In this section, we illustrate the key themes. We show that innovation owed much to the efforts of individuals who used their organizational positions to acquire resources, establish collaborative processes and structures, and create strategic meaning for individual projects. We demonstrate that these innovative efforts were, however, one-time events: they occurred in spite of organizational systems, not because of them, and were, accordingly, fragile and vulnerable rather than parts of a sustained process. Finally, we describe a particular problem in these organizations: the difficulties in creating organization-wide strategic meaning and value for innovation.

TABLE 3
Cases Classified by Proportion of Solved Project-to-Organization Problems

Case Number	Product	Percentage of Problems Solved	Company	Success Status	Degree of Innovativeness	Stage of Development
Top 10—Most project-to-organization problems solved						
1	Chemical	100	LUBCO	In development	Medium	Middle
2	Document system	100	DOCCO	Success	Low	Middle
3	Lubricant	83	FLOWCO	In development	Medium	Middle
4	Engineering plastic	80	CHEMCO	In market, unclear	Medium	Middle
5	Building product	75	BUILDCO	In development	Low	Middle
6	Medical system	68	CHEMCO	In development	High	Middle
7	Engine	67	MACHCO	In market, unclear	Medium	End
8	Office machine	60	DOCCO	In development	Medium	Middle
9	Robot	56	BUILDCO	In development	High	Middle
10	Food item	56	FOODCO	Success	Medium	End
Bottom 10—Fewest project-to-organization problems solved						
31	Office machine	17	DOCCO	In development	High	Middle
32	Waste remediation	3	CHEMCO	Canceled	High	Middle
33	Information package	0	DATCO	In development	Medium	Middle
34	Information package	0	DATCO	In development	Low	End
35	Chemical	0	LUBECO	Failed	Medium	End
36	Lubricant	0	LUBECO	In development	Medium	Middle
37	Computing system	0	INFOCO	In development	High	Middle
38	Bond	0	BANKCO	Successful	Low	Middle
39	Bond	0	BANKCO	In market, unclear	Low	Middle
40	Bond	0	BANKCO	Failed	Low	End

Resources

To understand difficulties in acquiring resources, we looked closely at the problems innovators had working with senior managers and gaining access to resources in other functions or divisions. In the high-problem-solution cases in Table 3, at least some resources were available, but they were not deliberately designated to support innovation, existing more as slack that innovators could only access by working their networks. Innovators called on acquaintances developed during a lifetime with a firm and used position and location (for instance, as head of a lab or of an office at corporate headquarters) to beg, borrow, or steal resources. A corporate planner with more than 25 years of experience at CHEMCO (case 4 in Table 3) described how he provided a young researcher with access to senior managers, who in turn provided support to develop a new engineering plastic material:

> This material has unique properties—it can be molded very easily but the molecules line up tightly in one direction so the material is strong as steel in that direction. So I told the executive vice president that I had a gut feel that we had a success here. I set up a couple of reviews where Jim [the researcher] would come in and talk to the VP. They hit it off very well, and Fred [the VP] thinks Jim is very clever.

The planner then worked his own networks further to keep the project funded:

> Fred and I would meet in the men's room, and I'd drop little hints, like "Gee, we're looking at new breakthroughs," or "Hey, all 21 claims on the patent were approved." Then I worked with the research management at the lab to convince them to fund this.

His descriptions of events show how he used his corporate staff position, reputation, and acquaintances around CHEMCO to nurture this new initiative and to generate support. Later on, the project was officially sanctioned and a project leader was formally appointed. But the new project leader saw most of his resources stripped away almost immediately, as he explained:

> In September I was brought back from London and given the job to bring the product out, and a budget of several million dollars. But then the corporation believed that there would be a recession in the next year, so this project was on the plate to be cut. I was then set up only with R&D in the budget, and everyone else had to commit time on their own.

The new project leader was, however, able to "hustle" resources informally to get around this arbitrary decision from corporate headquarters, as the planner described:

> Jim has done a very good job of convincing people to commit themselves. He was hustling out of the electronics division research, and now almost every division except commodity chemicals and agriculture is involved.

Critical resources were not deliberately provided to assure effective problem resolution. Indeed, even committed funding was removed as the innovation got caught up in routine corporate belt-tightening. Senior managers seemed to expect innovators to survive on their own. Two years later, the project had lost the support of the U.S. marketing group, and the project leader was looking for a new home in Europe.

One might argue that this case demonstrates good championing and boundary spanning (Ancona & Caldwell, 1990; Roberts, 1988) and that these activities are sufficient for successful innovation. However, when we compared the experiences of these savvy old-timers with those of much younger or more marginal innovators working on the hazardous waste remediation project at CHEMCO (case 32 in Table 3), we could see the limits of relying on individuals rather than on organization-wide support. The hazardous waste product was a biology-based approach to toxic waste remediation, and its champion was a young chemical engineer in his late twenties. He had moved from a plant in Alabama to corporate headquarters in the northeastern United States to carry out his plan, so he was willing to take risks. He had received approval to develop the idea from a corporate committee and was told he could have resources from several divisions. However, he could not arrange to get these resources from the divisions in a timely fashion.

Compare his understanding of how things should work with the savvy networking and hustling of his older, wiser CHEMCO colleagues quoted above:

> We presented the plan to the corporate committee in June of last year and got buy-in to build a team as requested. We were given a trial period of two years. All the plans were based on a team being in place by the end of last year, but it's only been in the last three months that I have gotten any people. I am still facing the same deadline, but my 1.5 years has shrunk in half. The past year has been the most frustrating period of my life, trying to get these things off the ground. It turned out that nobody wanted to live up to their commitments. Everyone said: "Gee, we have a manpower shortage. You just wait until the budget is approved." It was the kind of a deal that you feel great when you come out of the room, but all of a sudden the obstacles come up, but only one at a time. You clear one and another comes out. It just wore me out.

He did not know how to acquire resources and was too naive to appreciate the need to do so. Unfortunately, his two team members were equally inexpert: one was new to CHEMCO and the other had worked within corporate R&D only. They also described frustration in not getting resources. Although the organization officially sanctioned these individuals' drawing resources from multiple divisions, it did not provide the means for doing so. The R&D engineer described their difficulties:

> We have zero autonomy over funding and equipment, and no control over the project or who we hire, or even whether we can go on trips. You need to ask two bosses for everything. . . . The basic concept of our being a venture in the first place is to get to market or to a decision point quickly rather than create the normal administrative overhead, but that has not happened. Assume you need a piece of equipment that costs $430,000. I go to the first boss and they all agree that I need it, and they say OK. Then I go to my own manager, and he says that he will only provide money for my salary, not capital expenses. He says,

> "Why should we give the other division capital money? We are already doing them a favor by giving them you." Then you go back to the other side and they say "Well, if the project does not work, then the equipment stays with engineering, so why should we buy it?" The decision making is such a lengthy process that has become so complex that it just stops.

During the year following the first interviews, the young champion quit the project, and a year later the project itself was canceled. The product may or may not have been a good idea, but CHEMCO took over five years and made a considerable investment to decide not to proceed. When resources are not systematically available, those without experience or political savvy are at a disadvantage and find it difficult to secure necessary resources. Consequently, their projects suffer regardless of how good they may be.

Even innovators with good networks can encounter difficulties procuring major resources such as assistance from manufacturing. For example, the new engine at MACHCO (case 7 in Table 3) was saved from cancellation by a long-time member of the research staff who used his personal credibility to convince senior managers that the product had merit. He explained

> [After the prototype unit fell apart in a demonstration] George White (a VP of the business) called for a total review. There was no question that his plan was to stop it, because MACHCO was losing money at the time and they wanted to cut out anything that did not make sense. I became convinced that we were on the right track but using the wrong mechanism, so I asked George to give us another shot. I promised to have it working in eight weeks, and I did. Then George said he would back us for two years provided we had something ready to sell. We sold the first model in six months.

Although senior managers were willing to support the engineer, he ran into problems because the strong boundaries between the functions at MACHCO prevented the acquisition of manufacturing resources. As the researcher explained,

> Manufacturing was not involved with the project because we knew what they would say—no. This product is very difficult to make. I did contact a manufacturing manager and he agreed to meet me out here one Saturday, but that meeting never happened.

Manufacturing was not part of his normal network, so he had no way to procure resources that division controlled. (The manufacturing manager we interviewed about the engine dismissed the project and instead told us about another innovation.) As a result, the engine innovators went to an outside vendor to manufacture a key part. Two years later the follow-up interviews showed that the key part was breaking down in the products already sold and that the project was now in serious jeopardy. The supposed solution to the lack of resources had not worked.

When we examined the bottom 10 cases, we found similar problems with access to resources. For example, 3 of the cases with the lowest number of problem solutions (cases 38–40 in Table 3) come from BANKCO, which was organized in functional departments that had always worked separately and had had no experience with product innovation. Consequently, the resource allocation system had never addressed innovation before. BANKCO formed a new product project management unit and layered it over the very strong functions. However, simply adding a formal structure and giving official notice that all functions should cooperate did not align resources with innovation. To make matters worse, BANKCO was starting to downsize, draining the usual slack from the system. As one employee said

> The biggest obstacle for doing new products is resource constraints. We like to do a hundred things. Right now we are not suffering from an absence of ideas, and bunches of things get on the conveyor belt. You jump on with your product, and there are lots of products right ahead of you. So the obstacles now are selling the idea and making sure that everyone thinks it's a good one.

Comparing the top 10 cases with the bottom 10 cases, we found only differences in the degree of access to resources, not differences in the kind of access; in neither set of cases did the organizations provide access to the necessary resources. Rather, resources were targeted toward established businesses, and individual champions did not have enough power to shift entire systems to solve project-to-organization resource problems. Other individuals were unsuccessful because they were new to the game and lacked adequate networks or had no networks at all. As we examine the question of resources, we see a link to structure and processes: one of the reasons resources were difficult to obtain was that organizational processes also failed to support innovation. Structures and processes nurtured functional fiefdoms and conservative decisions rather than encouraging cross-functional activity and risk taking. The next section examines these processes in more detail.

Collaborative Structures and Processes

We looked for how well structures and processes involved organizational members, both laterally and vertically, in selecting, defining, and refining innovation projects. We found that structures and processes sustained routine work, not innovation. Many of the innovations had teams, but the extensive collaborative processes recommended in the literature were not in evidence. Nor did decision making flow upwards and sideways, nor relate evaluation criteria to innovation.

As we anticipated from the literature, we found that power imbalances played an important role in the lack of collaboration. In some cases, different functions were not equal. Even in DOCCO, the most innovative company in our sample, projects were driven by engineering, and marketing and sales played more marginal roles. Similar technological domination occurred at CHEMCO, even though all the innovations used teams. The salesperson who worked on the engineering plastic (case 4 in Table 3) explained how cross-functional teams were new and still uncomfortable in a firm dominated by science:

> I was assigned to work with these folks even though I am in the sales division. I am an essential member of the team, but this has seldom if ever happened in the past. Me working with these engineers did not come all that easy in a company as hidebound science as we are.

His comment suggests that although collaborative structures existed, they did not really lead to collaborative working processes, because of power imbalances and a lack of commitment to collaboration.

Strong functional boundaries also inhibited innovation. Most of the time, manufacturing people were not included in innovation teams. In the case of the engineering plastic, the hustling project manager had, in fact, angered people at one potential site by attempting to force his way in. The situation was redeemed only because the planner had previous ties to the plant site.

> Jim has the manufacturing people livid. He went in and said: "Don't tell me you can't do it; just tell me what you need and I'll go get it." But the manufacturing guys were all upset that they were not involved earlier. Our manufacturing types like to go by the book, so the problem is still very sensitive. But I know the plant and its culture from my fibers background, so I was able to manipulate around the problem.

So, although cross-functional teams were formed, they were often incomplete and ineffective. And there were no organization-wide mechanisms for weaving new products into ongoing production processes.

Another barrier to effective innovation was a lack of collaborative vertical relationships. Many of the innovators described how their innovations were bumped from agendas and budgets as a matter of course. For example, a chemist at FLOWCO working on a new industrial gas (case 3 in Table 3) explained the lengthy delays in getting his product going as follows:

> I conceived of the need about three years ago. I added an agent to XXX and postulated several possibilities for development. But management is skeptical and they prefer to wait for another budget cycle, or if it is a bad year they turn down a proposal. Last year I transferred over here and made it an objective to get started. Management still held off on buying the equipment, so it took us another three months to buy the furnace. . . . We travel very linearly until we have a winner.

He secured senior management attention and funding only after three years, because FLOWCO did not have a systematic problem-solving process. Innovations often encountered delays and postponements, as day-to-day processes of decision making and budgeting were oriented to routine work, not innovation.

Contrasting these experiences with BANKCO's cases in the bottom 10 in Table 3 again suggests that the primary difference was a matter of degree, not kind. At BANKCO, because innovation was new, processes were aligned with function-based decision making. Not surprisingly, people in the functions did not known how to collaborate when they did start innovating. As one manager explained:

> One problem is the individual functions, which often say that they will not work on a problem until the new products division calls a meeting. There is less interest in new products in some functions, like information systems. They announced in a meeting that the system could not handle the security administration for this product. It is really a matter of personalities, because that department has a single focus. You need power and the ability to push them, but most people don't know how to push them.

In these organizations, then, structures and processes were not designed to channel the kinds of decisions, participation, and problem solving necessary for innovation. Often, there were no workable ways to bring all departments together, to link different levels of hierarchy, or to make meaningful judgments of different projects. "Politics as usual" prevailed because there was no force for change. People often did not know how to collaborate laterally and vertically because collaboration across these boundaries was not part of their day-to-day repertoire of work. Sometimes, individuals in particular positions, with particular expertise and particular networks, could fill this vacuum through their own knowledge of how an organization worked. They were able to bridge departments, engender participation in teams, circumvent restrictive decision criteria, and secure approval from senior levels. Such solutions were, however, highly tenuous because such activity had no meaning for the wider organizational community. So, as our problem of resources led us to examine structures and processes, our discussion of structures and processes leads us to consider strategic connections.

Strategic Value and Meaning

To explore this connection, we examined the fit between the innovations and the firms' strategies, and whether the innovators encountered anti-innovation climates. Our findings show that working out strategic connections was highly problematic, as have the findings of others (Burgelman, 1983; Fast, 1978; Sykes, 1986). Our analysis also suggests why these connections were so difficult: innovation was not valued, so its constituent activities were perceived to be neither legitimate nor part of individuals' responsibilities. Moreover, there were few strategic conversations (cf. Westley, 1990) open to the lower-level people who innovated. Innovation had no permanent or inherent strategic meaning, certainly none that outlived regular changes in senior management. At best, belief in innovation was localized in time or place.

In a number of cases, when senior managers or their attitudes toward innovation changed, support for the projects declined or disappeared entirely. The marketing manager of the new food item at FOODCO (case 10 in Table 3) explained that the team was now spending a good deal of its time reconfirming product specifications and market projections at the behest of senior management, rather than focusing on the market launch and organizing the business:

> The management now are conservative. I think that if this were a year ago, we would not be confronting this conservative concern.

At OPCO, the vice president who sponsored one new project left the firm, and the businesses were restructured into separate market segments. Because of these changes, the project lost its support and was canceled, despite two years of extensive development. The woman in charge of market analyses explained that the new officers involved with the project had no "buy-in" since they were not familiar with all the data that had been developed:

> There has been a change in structure between before and after. The officers of the corporation now had no buy-in. If they had been involved before they would have been living with all the data. The old VP was a supporter. The new VP was not. The official reason for discontinuing the project was that "we have since discovered that customers really do not want [this service]." But that market research never got done.

To be sure, corporate strategies necessarily change, but if the strategic attention span is shorter than the development time of the average innovation, then an organization does not value innovation. In these firms, innovators described open, trusting strategic conversations that suddenly ceased when the management changed. Strategic conversations, when they did occur, were localized events, not part of normal organizational functioning.

In firms in which senior managers did not change so often, people described a risk-averse, short-term focus that clearly did not value innovation. The leader of the new plastic project at CHEMCO explained how this perspective had permeated the shared understanding of the firm's reward system:

> It is difficult for anyone running a big business to get excited about taking money off the bottom line. It is easier for people working here to ride the wave rather than stick their neck out. If

> you do stick your neck out it is either positive or negative. You will either fail or succeed. If you succeed you will not be much better off than if you hadn't done anything, but if you fail, you lose, you are out.

He went on to explain that anyone could take risk at CHEMCO, provided they were willing to take the consequences. Risk was not mediated by the organization.

A project manager at FLOWCO was more pointed about the lack of strategic value for innovation, despite a memo from the president in favor of innovation:

> I am so frustrated with the lack of support from management. A year ago Rick Burns [the president] sent out a memo about being entrepreneurial. So I wrote him back and we had lunch. That gave me an idea on how to talk to management—you have to hold a gun to their heads, and I use his memo to push them to help out.

The project leader for successful document processor at DOCCO (case 2 in Table 3) explained that they had only recently begun to incorporate innovation into their organization systematically. Before, innovation had occurred only occasionally and had not been embedded in the web of everyday meaning, expectation, and conduct:

> Before this project, we would put out a new product every four years. They would appoint a chief engineer (project leader), and he would go around and get people. It would take six months to get a group to coalesce, and a year before they had the team up and running, because you get such in-fighting between the units and divisions. That is the reason that it would take four years to get the product out. So after the project the team would be disbanded, and they would appoint another chief engineer, and he starts all over again.

The project leader described how DOCCO's new system made the practices of innovation meaningful by making them part and parcel of everyone's work:

> Two things have changed. First, we've invested a lot of money in a residency program (with a key foreign division that participates in this product line), so that people can spend time there and learn to work with these people. The team is made up of people with this experience. Second, after we put this team together we will keep it in place. By keeping a constant team in place, I have a lot of talent and a lot of depth. All of my team is seasoned, and the average age is 47, so they know where all the bodies are buried. These people are not fast trackers, but they can do things in a day that takes other people weeks.

BANKCO had never developed strategic conversations of any kind, since senior managers did not work with operations-level people on innovations. Instead, the operations-level people constantly had to negotiate and renegotiate support from a subordinate position. The person managing the new product efforts pointed out that setting up good teams was not enough: senior managers got in the way of innovation because they did not understand or believe in it. Contrasting BANKCO with another company at which she had worked, she suggested that innovation had no meaning for BANKCO's officers:

> The task force members take the product back to their departments for review, but the department officers could reject the product for no good reason. At BANKCO we have officers coming out of the woodwork. The are like a pantheon of gods who sit over here and say no. So you can't just get all the right people on the task force, because making innovation happen is not only a matter of that. At XCO, where I had worked before, things were more understood, it was more understood by everyone what was going to happen, so you could get new projects through. Here at BANKCO, there is no sense that people understand what we are trying to do with innovation, and no personnel policies that support it.

So, although product innovation was officially sanctioned at BANKCO, how and why it fit into the organization was not understood. Senior department heads still decided issues in favor of routine practice. In such a situation, strategic conversations may ostensibly occur between senior and middle managers, but they do not address the fundamental issues. They are either concerned with etiquette and status (i.e., people having to prove their eligibility to participate in the conversation), or they are briefing sessions in which senior managers are brought up to speed on a particular project that they do not really understand. In both cases, innovation has no strategic meaning.

Ideally, innovation should be integrated into an organization's strategy, the rules governing eligibility should be clean, the background information should be well known, and senior managers should take on the responsibility of sponsorship, helping champions to access resources and processes. In that situation, a strategic conversation can address key issues of content. But this was not the case with our sample. New products were excluded from the strategic thinking that was driving restructuring and performance evaluation. Consequently, product innovation took a back seat to other initiatives. Without strategic meaning, product innovation, with all its attendant risks and uncertainty, is particularly tenuous and fragile, and easily rooted out. When meaning is lost, processes and resources unravel as well.

AN ANTI-INNOVATION ORGANIZATIONAL CONFIGURATION

Our findings suggest that even when product innovation did occur, it did so in spite of organizational systems and only because of the unstinting efforts of individuals who bucked the system. Only in one case, DOCCO's document system, were resources really available, collaborative processes in place, and strategic meaning and value attached to innovation, in anything like the ideal organizational configuration recommended in the literature.

The experiences of the four other successful cases add further support for our contention that these organizations were configured against innovation: innovation had to be created and sustained by the innovators themselves, who succeeded only by walling themselves off from the anti-innovation configuration in the rest of the organization, in separate new product units. These units created bubbles of innovation meaning that approached the ideal type, where innovation had legitimacy and value in the eyes of the participants. These bubbles were self-contained, micro configurations in which resources, processes, and meaning were aligned with innovation. For example, the manufacturing manager with the successful product at FOODCO described how his team generated a sense of legitimacy for innovation by working apart:

> I have been involved with a lot of different development projects, because that has been my job. But this project is very different, in that we have much more authority and responsibility, and make more of our own decisions. The team sits as a group to make decisions, which gives us more responsibility. . . . No one is really in our way, because we make our own decisions.

The senior scientist who worked on the successful chemical at CHEMCO also attributed the group's success to its separation from management:

> Our top management should get a lot of the credit for this because they set us up and then left us totally alone.

These bubbles were vulnerable, however. First, most of the top 10 problem-solving cases (Table 3) were managed by old-timers; 3 of the bottom 10 were managed by young people who had only a few years experience with their firms, and 3 were in BANKCO, which, as we have illustrated, was new to innovation. People with more tenure in firms solved more project-to-organization problems than others (the difference was statistically significant) by drawing on their deep familiarity with their organizations. Their expertise and extensive networks of relationships in the firms enabled them to cajole resources, to cross major functional and divisional boundaries, and to gain legitimacy from senior managers. Projects managed by organizational neophytes were particularly vulnerable because they lacked political savvy and credibility and had yet to develop personal networks. Second, 9 of the 10 cases in Table 3 occurred in companies that were stable during the time of the interviews, and 4 of the bottom 10 were in companies undergoing extensive downsizing. Downsizing usually means fewer resources, as innovation is supplanted by cost cutting and reporting relationships and networks are disrupted.

In summary, the anti-innovation configuration of resources, processes, and meaning in these firms made sustained innovation very unlikely, and even separate innovation projects were vulnerable. When things got tough, the power available to innovators (knowledge, networks, contacts, and so forth) was rarely adequate to counter the power embedded in the organizational systems, which were aligned to prevent innovation. To develop the capability for sustained innovation, large, mature organizations cannot focus simply on the management of individual projects. They must also create organization-wide systems that weave together innovations and existing operations.

DISCUSSION: THE POWER OF ORGANIZATIONAL CONFIGURATION

This study has enabled us to move beyond the idea that large, mature organizations have difficulty with sustained innovation and to explain more precisely why this is so. The study is limited and does not take into account all organization-level problems. Nonetheless, we found that large, mature organizations could not achieve sustained innovation because innovators within them could not solve innovation-to-organization problems. The availability of resources, processes, and meaning was piecemeal in most of the organizations, and it depended primarily on individuals rather on the organizational system. Product innovation, when it did occur successfully, was powered by the operational and middle levels of the organizational hierarchies and based largely on the particular networks, connections, and experiences of lower-level managers. But rather than celebrate lone champions and other individual heroes, we suggest, as did Schon (1963), that primary reliance on such personal power is inherently ineffective for sustained innovation. Such power is limited by the reach of individual networks, knowledge, and experience and is easily uprooted by downsizing, restructuring, and changes in senior managerial focus. Moreover, it is unavailable to young people and newcomers who lack experience with an organization, as well as to people in organizations that have no history of building informal systems to get around formal ones.

We do not dispute that power is an integral part of product innovation. Product innovation does not happen spontaneously or magically—power is needed to facilitate, orchestrate, and shape it (Frost & Egri, 1991). According to Kanter, "What it takes to get the innovative organization up and running is essentially the same two things all vehicles need: a person in the driver's seat and a source of power" (1983: 216). But our findings suggest that the conceptualization of power must extend beyond the personal and encompass the organizational. For large, mature organizations to become innovative, they must reconfigure the power embedded in the organizational system—in its resources, processes, and meanings. Unless product innovation has an explicit, organization-wide power basis, there is no generative force, no energy, for developing new products continuously and weaving them into ongoing functioning. We agree with both Burns and Stalker (1961) and

Schon (1963): senior managers must alter their organizational systems of power if their organizations are to become capable of sustained product innovation—that is, capable of more than the occasional success.

Unfortunately, discussions of power in the innovation and management literatures tend to emphasize the personal power of individual managers and, more specifically, the power associated with the control of resources (e.g., Pfeffer, 1981; Pfeffer & Salancik, 1974). Accordingly, studies of power focus on individuals' control of such resources as budgets, information, expertise, sanctions, political access, and credibility (e.g., French & Raven, 1968; Pettigrew, 1973). Even work that adopts a departmental perspective (e.g., Hickson, Hinings, Lee, Schneck, & Pennings, 1971) directs attention toward resources—or contingencies—that allow a particular unit to control uncertainty and render itself immune to substitution.

Such work only scratches the surface of power dynamics (see Clegg, 1989; Hardy, 1994; Hardy & Clegg, 1969; Lukes, 1974). For example, Bachrach and Baratz (1962) pointed out that power is also exercised in "nondecision making," by suppressing opposition, keeping it out of decision-making arenas, and confining agendas to safe questions (Crenson, 1972; Hunter, 1980). In other words, power also lies in processes. Traditionally, research has focused on how such power inhibits change and innovation; more recently, however, work has been undertaken that shows how the power embedded in processes can be mobilized to encourage and stimulate change (e.g., Hardy & Redivo, 1994). In addition, power also lies in the deep structure of meaning whereby activities possess or lack legitimacy (Clegg, 1975; Frost, 1987; Hardy, 1985). By managing meaning (Pettigrew, 1979), managers can create momentum for the activities associated with innovation. So, as researchers incorporate these dimensions of power, they can start to see how power can be grounded in an organization, and not just tenuously held in the hands of an individual or even a department. In this way, the concept of power is deepened from its focus on resources to include processes and meaning and broadened from its focus on the individual to encompass the organization.

A quick fix to innovation problems would be for organizations to build up networks of personal power—by, for instance, training champions and sponsors, retaining old timers with networks, knowledge, and expertise, mentoring youngsters and newcomers to help them learn the political ropes, and separating innovations into self-contained new product units. However, the longevity of such a solution is limited so long as innovation remains a foreign body in a system that values the routine. Such a solution is weak especially when downsizing, mergers, and restructurings disrupt networks of personal power and reduce slack resources. We propose, instead, that organizations take a more lasting approach to developing an organization-wide capability for sustained innovation by changing the underlying configuration of power, from a personal network base to an organizational system base.

Without meaning to support product innovation, resources and processes easily unravel. Thus, the power of the meaning supporting innovation is crucial. If senior managers focus on managing the meaning of innovation and make concomitant changes in processes and resources, it is, we suggest, possible for large, mature organizations to become capable of sustained innovation. We know from theory that deep structures like power are tied to micro structures of everyday action (Drazin & Sandelands, 1992; Morgan, 1986). Our analysis suggests that actively targeting the two missing elements of meaning at the day-to-day level of behavior might spearhead a move toward sustained innovation.

First, managers need to make the activities of product innovation more meaningful to people throughout an organization. Altering everyone's understanding will take time, but managers can begin by making sure that nothing contradictory, such as cost control or not rocking the boat, has greater meaning. This step is an essential symbolic move necessary to counter the deep mistrust we found regarding senior management's commitment to innovation. Cost cutting need not be ignored, but it must be redefined to be consistent with product innovation practice. In addition, managers can build in more systematic approaches to working out the kinds of project-to-organization problems we described above, such as acquiring equipment and funding after an annual budget has been finalized, or moving new products into manufacturing more quickly. These systems need not be redesigned to support only innovation, since resources allocated to product families and technology platforms can combine innovation and routine (Wheelright & Clark, 1992). Jelinek and Schoonhoven (1990) showed how manufacturing can emphasize both cost efficiency and new product introduction if manufacturing managers are rewarded properly and given the resources needed to work out the complex interfaces; for example, they need money to fund pilot lines and enough experienced staff to oversee the connections between new and old products.

Second, we showed that these large, mature organizations had few strategic conversations (Westley, 1990) between senior and middle managers in which both sides participated in enacting product innovation and the strategic context that framed it. By actively and deliberately engaging in open strategic conversations around product innovation, senior managers can initiate the recursive process of changing the deep structure of the power configuration and everyday action. The more people participate in these conversations, the more they feel energized. Consequently, innovators must not only be included but also given the opportunity to frame the conversations and steer the choices that are made (see Westley [1990] for more details; see Fiol [1994] for a related analysis). Eisenhardt's (1989b) description of how to make fast strategic decisions suggests that even in "high-velocity" environments, effective managers broaden the number of people involved in strategic conversations.

These two ways of increasing the strategic meaning of innovation can be reinforced by changes in processes and resources. A number of techniques have been developed to marshal what we would call resource and process power behind product innovation (e.g., Nevens et al., 1990; Wheelright & Clark, 1992). If implemented concurrently with changes in the meaning of innovation, processes can begin to link the right people and emphasize the right criteria, and resources can begin to flow to the right places. We think that a shift from an anti-innovation system to a pro-innovation one is feasible, provided that senior managers are willing to mobilize the power of meaning for innovation.

In conclusion, being capable of sustained innovation is not simply a matter of adding procedures, teams, champions, and visionary leaders, although these factors are important. We argue that sustained innovation requires a fundamental shift in the configuration of power in an organization that, in turn, may mean firing senior managers (e.g., Pfeffer & Salancik, 1978). Indeed, the failure to acknowledge the role of power, both in theory and in practice, may be one big reason why researchers and practitioners do not understand the project-to-organization problems with innovation well enough to do much about them.

Deeper study of both innovative and noninnovative organizations is necessary to develop our model for powering innovation. Process studies of organizations that are attempting to change are especially important, because they examine whether and how reconfiguring power enables organizations to become more innovative. The rationales of senior managers in these organizations should also be assessed. Other kinds of mature organizations should be studied to see if the problems we found in our limited sample exist there, and if other issues also exist. Future research should also address the links between market and technological change and organizations. Finally, we have focused only on product innovation; how to organize for other kinds of innovation, and whether that is the same as organizing for product innovation, are important questions. Broadening the scope of the innovation literature to include sustained product and service innovation in large, mature organizations opens up important new frontiers for research.

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APPENDIX
Coding for the Data Analysis

Innovation Problems

One of the authors worked with a doctoral student to first identify each problem in each interview and then to categorize the problems into one of eight types. Classifying the problems into eight original types was difficult; in preliminary coding of six cases, the interrater reliability ranged from 68 to 90 percent. These rates suggested too great a variation, so we made further distinctions among the categories of problems and established more decision rules for placing problems. Then each interview was coded again separately by each researcher, and discrepancies were discussed. This process did not produce interrater reliability ratings, but the interactive coding helped to clarify the problem types. For this study, a team of undergraduate research assistants recoded the eight types to separate out within-project and project-to-organization issues. The interrater reliability rates ranged from 80 to 90 percent, which suggested adequate consistency. We then grouped the problems into the resources, collaboration, and strategic meaning categories.

Solutions of Innovation Problems

All the problems were then coded for whether or not they were solved, and if so, how, by the author and the doctoral student. For solution, any indication that the issue was worked out was coded as solved, even if, as we illustrate in the text, some of the solutions seemed temporary or partial. The interrater reliability between the two coders was 84 percent in the first round of coding, indicating adequate stability.

Categories for Cases

Degree of innovativeness. The measure was based on the product manager's judgment of the product's unfamiliarity to the firm on five dimensions: market, application, technology, distribution, and manufacturing. We coded a product as low in innovativeness if it was unfamiliar in one or two ways, as medium if unfamiliar in three ways, and as high if unfamiliar in four or five ways. There are no widely accepted measures of innovativeness. Our measure is consistent with the usual distinction between familiar and new product technology and markets but includes additional dimensions.

Stage of development. The codings were early—an idea still being fleshed out prior to formal approval to proceed; middle—the product had been approved and development was proceeding; and end—the product was almost completed and ready to be launched.

Success status. The only difficult distinction was between the successes and products that were in the market but not yet successful. We based this choice on the degree to which the product was, according to the follow-up interviews, garnering expected revenues. Products that had had no or few sales, despite forecasts that they would, are coded as uncertain. We conducted a sensitivity analysis to see if including cases whose category was not clear with the successes affected the implications regarding the differences; no real effect occurred, although the actual numbers were slightly diminished.

Deborah Dougherty received a Ph.D. degree in management from MIT's Sloan School in 1987. Since 1992 she has taught in the policy group at McGill University, Faculty of Management. Her research considers new product development, problems understanding customer needs, how and why organizational barriers inhibit effective product innovation, and how these underlying barriers can be overcome, especially in large, established organizations.

Cynthia Hardy is a full professor in the policy area at the Faculty of Management at McGill University. She received her Ph.D. degree from Warwick University in the U.K. Her research interests focus on the role of power and politics in organizations, especially with regard to interorganizational collaboration, strategy making in universities, and downsizing. She is currently heading a team of researchers in Canada and Australia that is examining collaboration between business, government, and nongovernment organizations from a critical perspective.

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ASSESSING THE WORK ENVIRONMENT FOR CREATIVITY

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We describe the development and validation of a new instrument, KEYS: Assessing the Climate for Creativity, designed to assess perceived stimulants and obstacles to creativity in organizational work environments. The KEYS scales have acceptable factor structures, internal consistencies, test-retest reliabilities, and preliminary convergent and discriminant validity. A construct validity study shows that perceived work environments, as assessed by the KEYS scales, discriminate between high-creativity projects and low-creativity projects; certain scales discriminate more strongly and consistently than others. We discuss the utility of this tool for research and practice.

All innovation begins with creative ideas. Successful implementation of new programs, new product introductions, or new services depends on a person or a team having a good idea—and developing that idea beyond its initial state. Departing from the traditional psychological approach to creativity, which focuses on the characteristics of creative persons (e.g., Barron, 1955; MacKinnon, 1965), we assume that the social environment can influ-

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The reported research was conducted while Teresa Amabile, Regina Conti, and Heather Coon were at Brandeis University, and Michael Herron was at the California School of Professional Psychology.

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ence both the level and the frequency of creative behavior. Like other researchers (e.g., Stein, 1974; Woodman, Sawyer, & Griffin, 1993), we define creativity as the production of novel and useful ideas in any domain. We define innovation as the successful implementation of creative ideas within an organization. In this view, creativity by individuals and teams is a starting point for innovation; the first is a necessary but not sufficient condition for the second. Successful innovation depends on other factors as well, and it can stem not only from creative ideas that originate within an organization but also from ideas that originate elsewhere (as in technology transfer).

This article focuses on the intraorganizational foundations of innovation—creative project work by teams of individuals. It examines the psychological *context of creativity,* the work environment perceptions that can influence the creative work carried out in organizations. In two senses, the article addresses both creativity and innovation: Creativity is the seed of all innovation, and psychological perceptions of innovation (the implementation of people's ideas) within an organization are likely to impact the motivation to generate new ideas. Although there has been much theoretical work, and some empirical work, on the context of creativity over the past several years, there has been no reliable, valid method for adequately assessing the various work environment dimensions proposed to play a role. The instrument described in this paper, *KEYS: Assessing the Climate for Creativity* (formerly, *Work Environment Inventory*), and the conceptual model underlying it, were developed to serve that function. KEYS was designed to assess perceptions of all of the work environment dimensions that have been suggested as important in empirical research and theory on creativity in organizations.

BACKGROUND

Related Instruments

Few scholars have attempted to quantitatively assess the work environment for creativity, although there are some psychometrically sound instruments that assess perceptions of organizational environments in general. For example, the Organization Assessment Instrument (OAI; Van de Ven & Ferry, 1980) provides a reliable, valid, and comprehensive assessment of an organization's design, structures, and functions (Drazin & Van de Ven, 1985). The Work Environment Scale (WES; Insel & Moos, 1975) assesses employees' perceptions of several broad dimensions of their daily work environments. However, neither of these instruments specifically focuses on the organizational environment for creativity. Indeed, only one psychometric instrument designed for this purpose (besides KEYS) has been documented in the scholarly literature.[1] The Siegel Scale of Support of Innovation (Siegel

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[1] An instrument that appears similar in many ways to KEYS, the Creative Climate Questionnaire (CCQ), was developed in Swedish by Ekvall and his colleagues (Ekvall, Arvonen, & Waldenstrom-Lindblad, 1983). Although considerable data on Swedish companies have been

& Kaemmerer, 1978) assesses perceptions of leadership, ownership, norms for diversity, continuous development, and consistency. However, because the instrument was validated on school teachers and students, its utility in business organizations is uncertain. We developed KEYS because we believe that, for organizational theory, research, and practice, an instrument based in the organizational literature and tested in organizational settings is most appropriate.

Related Theories

Recent contextual theories of organizational creativity and innovation have attempted to identify dimensions of work environments that are related to creativity. In the componential model of creativity and innovation in organizations (Amabile, 1988), three broad organizational factors are proposed, each of which includes several specific elements: (1) *Organizational motivation to innovate* is a basic orientation of the organization toward innovation, as well as supports for creativity and innovation throughout the organization. (2) *Resources* refers to everything that the organization has available to aid work in a domain targeted for innovation (e.g., sufficient time for producing novel work in the domain, and the availability of training. (3) *Management practices* refers to allowance of freedom or autonomy in the conduct of work, provision of challenging, interesting work, specification of clear overall strategic goals, and formation of work teams by drawing together individuals with diverse skills and perspectives. The conceptual model underlying the development of KEYS is a more detailed and specific articulation of this componential theory.

Woodman, Sawyer, and Griffin (1993) took a similar theoretical perspective on creativity in organizations, but they extended their model in two additional ways. They included external influences as well as intraorganizational influences, and they gave prominence to intraindividual factors in their interactionist approach. In their model, creative behavior within organizations is a function of two categories of work environment inputs (inputs beyond the characteristics of the individual people involved in doing the work): (1) *Group characteristics* are the norms, group cohesiveness, size, diversity, roles, task characteristics, and problem-solving approaches used in the group. (2) *Organizational characteristics* consist of organizational culture, resources, rewards, strategy, structure, and focus on technology. KEYS also taps many of these aspects of the work environment.

Issues in the Assessment of Organizations

Most organizations are composed of a number of individuals working within various hierarchical groupings. In an R&D organization, for example, small teams of scientists and engineers might undertake product develop-

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collected with this instrument, its psychometric properties have not been documented in the scholarly literature.

ment projects; these teams might be led by project managers, who will be supervised by lab heads, who will report to division heads, who will in turn report to corporate executives. What *is* the work environment of such an organization? Is there one work environment, or many? What do self-report responses on perceptions of the work environment really measure?

In her seminal work on cultures and subcultures within organizations, Sackmann (1992) found that, although some aspects of an organization's environment can be considered homogeneous, other aspects can differ considerably across subgroups within the organization. Using quite different methods, Gersick found that the success or failure of a work team depends greatly upon the context or environment of the group, which is fashioned, in large part, by "the design and designer of the group" (1988: 35). Because both the design and the designer of a group can vary substantially even within the same organization, Gersick's findings and theoretical model suggest that different teams within an organization might experience quite different work environments. Moreover, in their theoretical and empirical work on the assessment of organizations, Van de Ven and Ferry (1980) proposed that subunits of a given organization can vary significantly in their effectiveness, their daily functioning, and the reactions that employees have to working within them. Thus, we assume that, although meaningful interorganizational differences should be expected on work environment dimensions, there will often also be meaningful intraorganizational differences between divisions, departments, and work groups. Furthermore, it might be assumed that even organization-wide elements, such as top management directives, might be perceived somewhat differently by different groups within an organization.

Previous creativity research on social-environmental influences in organizations has uncovered aspects of the work environment at the level of the organization, the level of project management, and the level of the work group itself. Although *influences* on work environment perceptions can arise at several different levels within an organization, KEYS and the model underlying it focus on *individuals' perceptions* and the influence of those perceptions on the creativity of their work. The underlying assumption is that self-report responses on a work environment questionnaire reveal respondents' perceptions—the psychological meaning that respondents attach to events in their organizations, their organizational units, and their work groups. Thus, the level at which the source of influence operates is less important than the perceptions themselves and their relation to creativity. Accordingly, this psychological model and the accompanying psychological instrument take the "total-work-environment level of analysis" approach outlined by Pierce and his colleagues (Pierce, Gardner, Cummings, & Dunham, 1989). For example, whether individuals feel their co-workers, their supervisors, or their high-level superiors encourage them to take risks in their project work, what is important is the fact that they perceive such encouragement. Thus, KEYS and its underlying model include perceptions of influences at several levels within the organization.

Because the model and the instrument are psychological in nature, focusing on perceptions, the correspondence to actual objectifiable aspects of the work environment need not be direct. According to contextual theories of organizational creativity, it is the psychological meaning of environmental events that largely influences creative behavior (e.g., Amabile, 1988; Woodman et al., 1993). Clearly, there must be some correspondence between organizational reality and work environment perceptions as assessed by KEYS, or the instrument would assess only individual personalities and would reveal nothing of use to managers. But rather than attempt to quantify actual events in the work environment, we focus on the work environment perceptions of project team members and the relationship between those perceptions and the creativity of the project outcomes. Once reliable relationships between work environment perceptions and the creativity of the work being done are established, we can embark on future research to determine the precise connections between events and perceptions.

CONCEPTUAL MODEL

Figure 1 depicts the conceptual model underlying KEYS. This figure includes the major conceptual categories of the model, specifying the KEYS scales that grew from each category and noting the predicted relationship between each scale and assessed creativity. The scales predicted to be positively related to creativity are referred to as "stimulant scales" and those predicted to be negatively related are referred to as "obstacle scales." The conceptual categories were developed from two primary sources. The first was a review of previous research. The second was a critical-incidents study in which 120 R&D scientists and technicians were asked to describe a high-creativity event from their work experience as well as a contrasting low-creativity event (Amabile, 1988; Amabile & Gryskiewicz, 1987). Independent raters coded transcriptions of these interviews; the work environment descriptors that were mentioned frequently by the interviewees fall into the conceptual categories in the model.

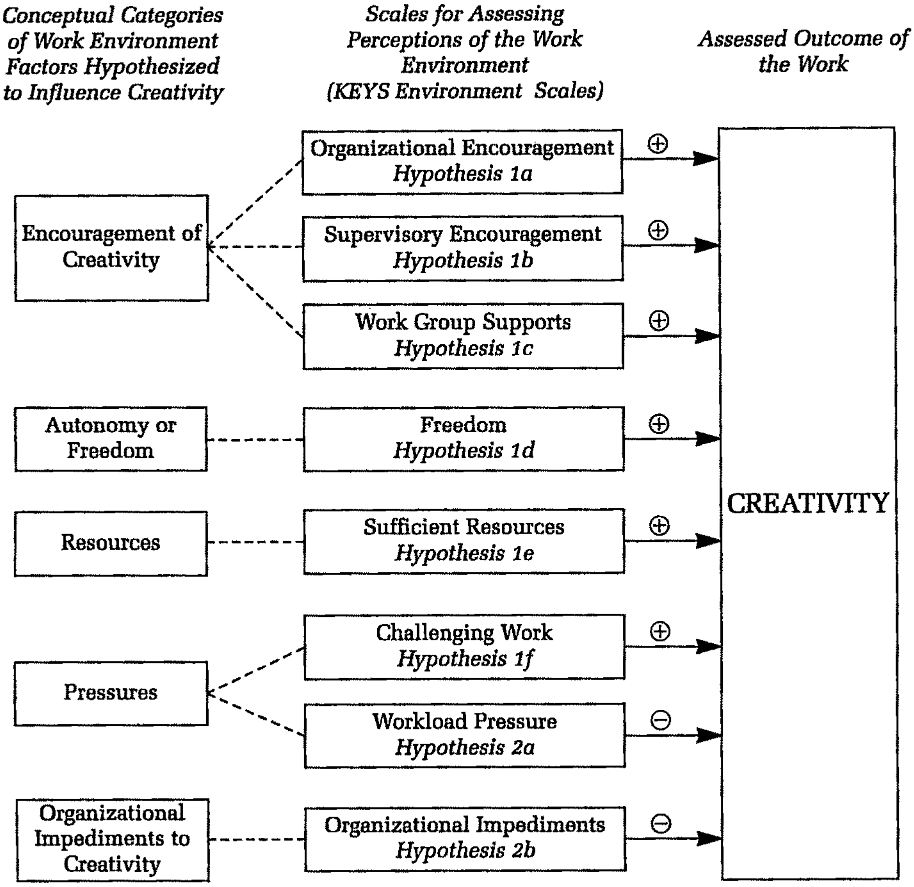
The conceptual categories are described here beginning with the most frequently mentioned findings and ending with those that have appeared only rarely in the previous literature. Within each category, psychological mechanisms underlying the hypothesized effect on creative behavior are briefly described. Many of these mechanisms derive from the intrinsic motivation principle of creativity: People will be most creative when they are primarily intrinsically motivated, by the interest, enjoyment, satisfaction, and challenge of the work itself; this intrinsic motivation can be undermined by extrinsic motivators that lead people to feel externally controlled in their work (Amabile, 1983, 1988, 1993).

Encouragement of Creativity

This dimension is, by far, the broadest and the most frequently mentioned in the literature. Encouragement of the generation and development

FIGURE 1

Conceptual Model Underlying Assessment of Perceptions of the Work Environment for Creativity[a]


Conceptual Categories of Work Environment Factors Hypothesized to Influence Creativity
Scales for Assessing Perceptions of the Work Environment (KEYS Environment Scales)
Assessed Outcome of the Work
Encouragement of Creativity
Autonomy or Freedom
Resources
Pressures
Organizational Impediments to Creativity
Organizational Encouragement Hypothesis 1a
Supervisory Encouragement Hypothesis 1b
Work Group Supports Hypothesis 1c
Freedom Hypothesis 1d
Sufficient Resources Hypothesis 1e
Challenging Work Hypothesis 1f
Workload Pressure Hypothesis 2a
Organizational Impediments Hypothesis 2b
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CREATIVITY

[a] The scales predicted to be positively related to creativity are referred to as "stimulant scales" and those predicted to be negatively related are referred to as "obstacle scales."

of new ideas appears to operate at three major levels within organizations. The first of these, organizational encouragement, appears prominently in the literature; the other two (supervisory encouragement and work group encouragement) are less frequently mentioned.

Organizational encouragement. Several aspects are perceived as operating broadly across the organization: (1) The first is encouragement of risk taking and of idea generation, a valuing of innovation from the highest to the lowest levels of management (Cummings, 1965; Delbecq & Mills, 1985; Ettlie, 1983; Hage & Dewar, 1973; Kanter, 1983; Kimberley & Evanisko, 1981). Psychological research on creativity has demonstrated that people are more likely to produce unusual, useful ideas if they are given license to do so by the situation or by explicit instructions (Parnes, 1964; Parnes & Meadow, 1959). (2) Fair, supportive evaluation of new ideas (Cummings, 1965; Kanter, 1983) is the second aspect of organizational encouragement. The expectation of threatening, highly critical evaluation has been shown to undermine creativity in laboratory studies (Amabile, 1979; Amabile, Goldfarb, & Brackfield, 1990). Moreover, field experiments have demonstrated that supportive, informative evaluation can enhance the intrinsically motivated state that is most conducive to creativity (Deci & Ryan, 1985). (3) Reward and recognition of creativity (Abbey & Dickson, 1983; Cummings, 1965; Paolillo & Brown, 1978) is the third aspect of organizational encouragement. Although engaging in an activity only to obtain a contracted-for reward can undermine creativity (Amabile et al., 1986), creativity can be enhanced by expecting a reward that is perceived as a "bonus," a confirmation of one's competence, or a means of enabling one to do better, more interesting work in the future (Amabile et al., 1986; Amabile, Phillips, & Collins, 1993; Hennessey, Amabile, & Martinage, 1989). (4) Finally, collaborative idea flow across an organization and participative management and decision making (Allen, Lee, & Tushman, 1980; Kanter, 1983; Kimberley & Evanisko, 1981; Monge, Cozzens, & Contractor, 1992; Zaltman, Duncan, & Holbeck, 1973) are important aspects of organizational encouragement. Creativity research has shown that the probability of creative idea generation increases as exposure to other potentially relevant ideas increases (Osborn, 1963; Parnes & Noller, 1972).

Supervisory encouragement. Several studies have pointed to the role of project managers or direct supervisors, particularly in the areas of (1) goal clarity (Bailyn, 1985), (2) open interactions between supervisor and subordinates (Kimberley, 1981; Kimberley & Evanisko, 1981), and (3) supervisory support of a team's work and ideas (Delbecq & Mills, 1985; Orpen, 1990). The results of research demonstrating the critical role of problem definition in the creative process (Getzels & Csikszentmihalyi, 1976) imply the importance of goal clarity in creative behavior. It is likely that open supervisory interactions and perceived supervisory support operate on creativity largely through the same mechanisms that are associated with fair, supportive evaluation; under these circumstances, people are less likely to experience the fear of negative criticism that can undermine the intrinsic motivation necessary for creativity (Amabile, 1979, 1983).

Work group encouragement. As a few studies have revealed, encouragement of creativity can occur within a work group itself, through diversity in team members' backgrounds, mutual openness to ideas, constructive challenging of ideas, and shared commitment to the project (Albrecht & Hall, 1991; Andrews, 1979; Monge, Cozzens, & Contractor, 1992; Payne, 1990). Team member diversity and mutual openness to ideas may operate on creativity by exposing individuals to a greater variety of unusual ideas; such exposure has been demonstrated to positively impact creative thinking (Parnes & Noller, 1972). Constructive challenging of ideas and shared commitment to a project are likely to yield increases in intrinsic motivation, because two of the primary features of intrinsic motivation are a positive sense of challenge in the work and a focus on the work itself (Amabile, Hill, Hennessey, & Tighe, 1994; Harter, 1978; White, 1959).

Freedom/Autonomy

Several researchers have concluded that creativity is fostered when individuals and teams have relatively high autonomy in the day-to-day conduct of the work and a sense of ownership and control over their own work and their own ideas (Bailyn, 1985; King & West, 1985; Paolillo & Brown, 1978; Pelz & Andrews, 1966; West, 1986). Studies of creativity have revealed that individuals produce more creative work when they perceive themselves to have choice in how to go about accomplishing the tasks that they are given (e.g., Amabile & Gitomer, 1984).

Resources

A number of researchers have suggested that resource allocation to projects is directly related to the projects' creativity levels (Cohen & Levinthal, 1990; Damanpour, 1991; Delbecq & Mills, 1985; Farr & Ford, 1990; Kanter, 1983; Payne, 1990; Tushman & Nelson, 1990). Aside from the obvious practical limitations that extreme resource restrictions place on what people can accomplish in their work, perceptions of the adequacy of resources may affect people psychologically by leading to beliefs about the intrinsic value of the projects that they have undertaken.

Pressures

Few studies have produced findings relevant to the question of the effects of pressure on creativity in organizations. The evidence that does exist suggests seemingly paradoxical influences. Some research has found that, although workload pressures that were considered extreme could undermine creativity, some degree of pressure could have a positive influence if it was perceived as arising from the urgent, intellectually challenging nature of the problem itself (Amabile, 1988; Amabile & Gryskiewicz, 1987). Similarly, Andrews and Farris (1972) found that time pressure was generally associated with high creativity in R&D scientists, except when that pressure reached an undesirably high level. We conceptualize these findings as identifying two distinct forms of pressure, excessive *workload pressure,* and *challenge;* the first should have a negative influence on creativity, and the second should have a positive influence. Psychological research suggests that exploration of alternative possibilities and time for that exploration directly correlate with the creativity of task outcomes in laboratory settings (Conti, Coon, & Amabile, 1993; Parnes, 1961; Ruscio, Whitney, & Amabile, 1995; Whitney, Ruscio, Amabile, & Castle, 1995). Thus, excessive workload pressure would be expected to undermine creativity, especially if that time pressure were perceived as imposed externally as a means of control (Amabile, 1993). But time pressure that is perceived as a necessary concomitant of an important, urgent project may add to the perception of challenge in the work that positively correlates with intrinsic motivation and creativity (Amabile, 1988).

Organizational Impediments to Creativity

Although there is little evidence beyond the critical-incidents study cited earlier (Amabile, 1988; Amabile & Gryskiewicz, 1987), some research suggests that internal strife, conservatism, and rigid, formal management structures within organizations will impede creativity (Kimberley, 1981; Kimberley & Evanisko, 1981). Because individuals are likely to perceive each of these factors as controlling, they may lead to increases in individuals' extrinsic motivation, and corresponding decreases in the intrinsic motivation that is necessary for creativity (Amabile, 1988; Deci & Ryan, 1985).

This brief review makes it clear that, in most previous research on the work environment for creativity, there has been a bias toward creativity supports—work environment factors that appear to enhance creativity. There is comparatively little research evidence on creativity impediments—work environment factors that may undermine creativity. Indeed, aside from the critical-incidents study that specifically probed for negative influences (Amabile & Gryskiewicz, 1987), only two studies have highlighted creativity obstacles (Kimberley, 1981; Kimberley & Evanisko, 1981). In developing the conceptual model depicted in Figure 1, and in developing KEYS to fit the components of that model, we attempted to include all work environment dimensions that might be important for creativity, including both negative and positive influences.

RESEARCH APPROACH

KEYS (Amabile, 1995) was designed to provide reliable and valid assessments of aspects of organizational work environment perceptions that are likely to influence the generation and development of creative (i.e., novel and useful) ideas. Its items were written to address all positive and negative aspects of the work environment described in the literature. KEYS was intended to serve as a tool for research and theory development, particularly for scholars interested in understanding contextual influences on creative behavior in work organizations. Specifically, scholars who use this tool in their research should be able to gain more detailed insight into the ways in which work environment perceptions can influence the creativity level of project outcomes. KEYS was also intended to serve as a tool for practitioners interested in diagnosing the degree to which an organization's work environment fosters creative work in individuals and groups.[2]

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[2] KEYS was developed through a collaboration between Teresa Amabile and the Center for Creative Leadership. Researchers interested in using KEYS in their work should contact Teresa Amabile, Harvard Business School, Soldiers Field Road, Boston, MA 02163. Others interested

KEYS research falls into two primary categories. The first is basic psychometric research on the factor structure and reliability of the scales, as well as their test-retest reliability, their convergent validity, and their discriminant validity. This research consisted of analyses of data from several different samples of KEYS respondents, collected over a period of several years. KEYS results, as well as results from other questionnaires administered to some of these samples, allowed examination of (1) the degree to which the KEYS scale structure fits a confirmatory factor analysis; (2) the reliability or internal consistency of the scales—the degree to which each item on the questionnaire statistically fits with the other items on its particular scale; (3) short-term test-retest reliability, to determine that respondents' answers are not random; (4) convergent validity, to determine that KEYS does assess aspects of the work environment, by correlating it with another, established measure of work environment; and (4) discriminant validity, to determine that KEYS scores do not simply reflect the respondents' personalities or cognitive styles. Such discriminant validity also increases confidence that the instrument is assessing something in the environment, external to the individual respondents.

The second category of KEYS research consists of a single major construct-validity study that was conducted in three phases. In the first phase, a set of high-creativity projects and a set of low-creativity projects were nominated within a single large organization. Preliminary assessments of the work environments of these projects were obtained using KEYS. In the second phase, independent experts within the organization rated the nominated projects on creativity. In the third phase, additional KEYS data were collected on subsets of the high- and the low-creativity projects. This study was designed to test the hypotheses outlined in Figure 1.

> *Hypothesis 1: The work environment stimulant scales on KEYS will be rated significantly higher in projects rated as highly creative than in projects rated as less creative. Thus, ratings should be significantly higher in the high-creativity projects than in the low-creativity projects for the following scales: (1a) organizational encouragement, (1b) supervisory encouragement, (1c) work group supports, (1d) freedom, (1e) sufficient resources, and (1f) challenge.*
>
> *Hypothesis 2: The work environment obstacle scales on KEYS will be rated significantly lower in projects rated as highly creative than in projects rated as less creative. Thus, ratings should be significantly lower in the high-creativity projects than in the low-creativity projects for*

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in KEYS should contact Bill Howland (910-545-3754) or Alice Plybon (910-545-3756), both at the Center for Creative Leadership, PO Box 26300, Greensboro, NC, 27438-6300.

the following scales: (2a) workload pressure and (2b) organizational impediments.

This study was also designed to determine the relative strength of the various work environment dimensions in differentiating between these distinct project outcomes and to examine the degree to which different project team members agree in their independent assessments of their project work environment using KEYS.

The remainder of this article first describes the psychometric research and then the validity research; it ends with a general discussion of the implications for theory, research, and practice.

PSYCHOMETRIC CHARACTERISTICS OF KEYS

Methods: Samples

The current KEYS database consists of 12,525 cases. Of these, 9,729 were participants in a variety of public management programs at the Center for Creative Leadership and the participants' co-workers at their home organizations (usually, groups of 4–9 individuals from a given organization). The remaining 2,796 respondents came from a variety of functions and departments in 21 different organizations. These organizations represent a number of industries, including high technology, biotechnology, and electronics; chemicals, pharmaceuticals, and health products; traditional research and development; traditional manufacturing; banking; and consumer products. These data were collected over the years 1987–95.

Methods: Measures

Work environment perceptions (KEYS). The original item pool for KEYS was composed by reference to the interviews in the critical incident study (Amabile & Gryskiewicz, 1987), theory, and previous work by other researchers; an attempt was made to comprehensively tap perceptions of all work environment dimensions that might serve as creativity influences. KEYS is currently in its fourth revision. Revisions of the instrument have consisted of rewriting, adding, and deleting items (cf. Amabile & Gryskiewicz, 1989; Amabile, Gryskiewicz, Burnside, & Koester, 1990). These revisions were based on statistical analyses of items and scales (including analyses of the normality of response distributions on items and scales, factor analyses, and internal consistency analyses), and on semistructured focus groups and individual interviews with corporate employees and managers who volunteered to discuss the instrument's items.

Of the 78 items on the current version of KEYS, 66 describe the work environment. The remaining 12 items are included to gauge the respondents' assessments of two work performance criteria: the creativity (6 items) and productivity (6 items) of the work being carried out in their units. All items on KEYS are written as simple descriptive statements of the work environment or the work. In order to avoid response bias, some items were worded positively and some were worded negatively. A four-point response scale is presented on KEYS; the intent was to avoid a midpoint in order to force respondents away from a neutral default option. The points on the scale correspond to a rating of "how often true" the statement is of a respondent's current work environment (never or almost never, sometimes, often, always or almost always). The instructions define "current work environment" as "the day-to-day social and physical environment in which you currently do most or all of your work."

The work environment scales on the current KEYS were derived by both conceptual grouping of the 66 environment items and examination of principal components factor analyses of those items. This process yielded eight environment scales, six assessing proposed stimulants to creativity (dimensions that should lead to higher creativity) and two assessing proposed obstacles (dimensions that should lead to lower creativity). The remaining 12 items form two criterion scales. Table 1 presents the scales' names, their descriptions, and sample items.

Convergent validity. The measure used to establish convergent validity was the Work Environment Scale (WES; Insel & Moos, 1975), a well-established general measure of work environments in organizations. Although this measure was not specifically designed to assess aspects of the work environment that are most relevant to creativity (as KEYS was), its scales should correlate moderately with KEYS if the latter instrument does indeed assess perceptions of the work environment.

Discriminant validity. Two measures were used to establish discriminant validity by demonstrating that KEYS responses do not simply reflect individual characteristics of respondents. Because KEYS is oriented toward creativity, a widely used measure of creative cognitive style was chosen. This instrument, the Kirton Adaption-Innovation Inventory (KAI; Kirton, 1976), assesses stable individual differences in the tendency to take radically different approaches to problems. In addition, because creativity is influenced by an individual's intrinsic or extrinsic motivation, a measure of motivational orientation was also chosen for the demonstration of discriminant validity. This instrument, the Work Preference Inventory (WPI; Amabile, Hill, Hennessey, & Tighe, 1994) assesses stable individual differences in intrinsic-extrinsic motivational orientation. If indeed KEYS responses reflect perceptions of creativity-relevant aspects of the external work environment rather than creativity-relevant characteristics of respondents, KEYS scale scores should be relatively uncorrelated with KAI and WPI scores.

Results and Discussion

KEYS scale structure and reliability. Maximum likelihood confirmatory factor analysis was used to evaluate the eight-factor model of the work environment scales. LISREL VII was used for the analysis (Jöreskog & Sörbom, 1986). The input matrix was a correlation matrix of the 66 work environment items from a database of 26 companies ($N = 3{,}708$). A simple struc-

TABLE 1
KEYS Scales

Scale Name	Number of Items	Description	Sample Item
Stimulant scales			
Organizational encouragement	15	An organizational culture that encourages creativity through the fair, constructive judgment of ideas, reward and recognition for creative work, mechanisms for developing new ideas, an active flow of ideas, and a shared vision of what the organization is trying to do.	People are encouraged to solve problems creatively in this organization.
Supervisory encouragement	11	A supervisor who serves as a good work model, sets goals appropriately, supports the work group, values individual contributions, and shows confidence in the work group.	My supervisor serves as a good work model.
Work group supports	8	A diversely skilled work group in which people communicate well, are open to new ideas, constructively challenge each other's work, trust and help each other, and feel committed to the work they are doing.	There is free and open communication within my work group.
Sufficient resources	6	Access to appropriate resources, including funds, materials, facilities, and information.	Generally, I can get the resources I need for my work.
Challenging work	5	A sense of having to work hard on challenging tasks and important projects.	I feel challenged by the work I am currently doing.
Freedom	4	Freedom in deciding what work to do or how to do it; a sense of control over one's work.	I have the freedom to decide how I am going to carry out my projects.
Obstacle scales			
Organizational impediments	12	An organizational culture that impedes creativity through internal political problems, harsh criticism of new ideas, destructive internal competition, an avoidance of risk, and an overemphasis on the status quo.	There are many political problems in this organization.
Workload pressure	5	Extreme time pressures, unrealistic expectations for productivity, and distractions from creative work.	I have too much work to do in too little time.
Criterion scales			
Creativity	6	A creative organization or unit, where a great deal of creativity is called for and where people believe they actually produce creative work.	My area of this organization is innovative.
Productivity	6	An efficient, effective, and productive organization or unit.	My area of this organization is effective.

ture was maintained; each item was permitted to load only onto one latent variable (scale). One item per concept was fixed at one to establish a scale for each latent variable. The factor variance-covariance matrix (phi matrix) was set as a free symmetric matrix. The variance-covariance matrix of measurement errors (theta delta) was a diagonal free matrix.

The overall fit measures show a moderate fit to the data (goodness-of-fit index = .85; adjusted goodness-of-fit index = .84; chi-square (2,051) = 17,305.48, $p < .001$; root mean square residual = .056), with the large chi-square value indicating room for improvement. The component fit measures show that all items loaded significantly onto their scales (p's < .001). The modification indices are quite high for many items, indicating that these items load onto more than one factor. Given the nature of the instrument, this is not surprising; the concepts measured by KEYS are theoretically related. Thus, although a more complex model (one in which items are permitted to load on several factors) would better fit the data, maintaining a simple structure was central to the purpose of separately assessing each aspect of the work environment that is thought to be related to creativity.

Table 2 presents additional psychometric data on KEYS. As can be seen, internal scale reliabilities (Cronbach's alpha) vary from minimally acceptable (.66) to extremely strong (.91), with a median that is quite good (.84). Indeed, only two of the scales (freedom and workload pressure) show reliabilities lower than .80. The environment scales generally intercorrelate at moderate levels, indicating elements of both commonality and distinctiveness in the different work environment dimensions. The test-retest reliabilities of the scales, across a period of three months, are good. Note that short-term test-retest reliability of an environment inventory is desirable, to indicate that responses are not merely capricious or influenced by highly transitory but irrelevant forces. However, we would not necessarily expect scores on an environment inventory to stay stable across long periods of time. As an environment changes, which most environments do, ratings on an environment inventory should also change.

Convergent and discriminant validity. The preliminary evidence on convergent and discriminant validity is encouraging. As seen in Table 2, the KEYS scales do correlate moderately with the scales on another work environment inventory, the WES. Moreover, KEYS shows relatively low correlations with a personality measure of motivational orientation, the WPI, and with a measure of cognitive style, the KAI. This pattern of correlations suggests that respondents' ratings of their work environments are not merely reflections of their own personal characteristics.

A first step toward asserting construct validity in a work environment instrument is to demonstrate that it discriminates between different work environments. As a start, it should yield different results for different organizations. A multivariate analysis of variance (MANOVA) on all KEYS scales, with company as the independent variable, indicated highly significant differences between the work environments of different companies (multivariate $F_{250,\ 38,410} = 10.59$, $p < .001$). In addition, step-down univariate analyses

TABLE 2
KEYS Summary Table[a]

KEYS Scales	Reliability: Alpha	Reliability: Test-Retest	Scale Intercorrelations: Median r with KEYS Stimulant & Obstacle Scales	Convergent Validity: Median r with WES Scales	Discriminant Validity: Median r with WPI Scales	Discriminant Validity: KAI r
Creativity stimulants						
Organizational encouragement	.91	.94	.49	.58	.02	−.11
Supervisory encouragement	.91	.90	.42	.43	.03	−.27
Work group supports	.86	.88	.42	.32	.00	−.16
Sufficient resources	.83	.75	.34	.45	.00	−.10
Challenging work	.79	.82	.36	.42	.03	−.14
Freedom	.66	.80	.36	.23	−.08	−.02
Creativity obstacles						
Organizational impediments	.84	.89	.41	−.53	−.03	.14
Workload pressure	.77	.71	.24	−.06	−.02	−.03
Criterion scales						
Creativity	.84	.87	.46	.43	.09	−.02
Productivity	.86	.84	.47	.46	.06	−.14
N	>12,100	40	>12,100	56	69	69

[a] All correlations are statistically significant ($p < .05$), except those in the last two columns (discriminant validity). WES is the Work Environment Scale (Insel & Moos, 1975); WPI is the Work Preference Inventory (Amabile et al., 1994); KAI is the Kirton Adaption-Innovation Inventory (Kirton, 1976). Median correlations are presented for those instruments having several scales.

of variance revealed highly significant overall across-company differences on each of the eight environment scales and on both criterion scales (all *p*'s < .001).

Thus, in general, the psychometric characteristics of KEYS are satisfactory. Further psychometric development of the instrument should be directed toward improvement of the reliability of the freedom scale, perhaps by the addition of items, and the collection of additional convergent and discriminant validity data.

A TEST OF THE VALIDITY OF KEYS

Although results on differences in KEYS scales across companies begin to establish the construct validity of KEYS, stronger evidence is needed. To this end, a study was conducted to test the ability of KEYS to discriminate between work environments where demonstrably creative work is being produced and work environments where notably less creative work is being produced. This study was designed to determine whether the stimulant scales would be rated higher (Hypotheses 1a–1f), and the obstacle scales lower (Hypotheses 2a and 2b), for work environments surrounding projects with highly creative outcomes, compared to environments of projects with less creative outcomes. A strong test of these hypotheses required that the highly creative and less creative projects be rated as such not only by members of the project teams but also by experts external to the project teams.

In addition, this study was designed to explore the possibility that certain aspects of the work environment might more strongly and consistently discriminate between high- and low-creativity projects than others. As noted earlier, in the literature on environmental influences on organizational creativity, certain dimensions appear more prominently: organizational encouragement of (or orientation toward) innovation, freedom (autonomy), and resource availability. However, there is no clear evidence on the importance of these factors, relative to the importance of others that have been mentioned, such as time pressure and the challenge level of the work.

Methods

The study was conducted at a company we call High-Tech Electronics International, a United States company of over 30,000 employees providing diversified electronics products to international markets. In phase 1 of the study, both technical and nontechnical middle-level managers were individually asked to nominate both the highest-creativity and the lowest-creativity project with which they had been involved during the previous three years in the company. For both projects, they were asked to select only from that set of projects in which *creativity was both possible and desirable;* creativity was defined as "the production of novel *and* useful ideas by individuals or teams of individuals." These managers were selected across four major divisions of the company. They briefly described each nominated project (using a standard questionnaire) and completed a KEYS on each project. They also provided some background information on themselves. The KEYS ratings in phase 1 were used to provide preliminary tests of Hypotheses 1 and 2 and to allow preliminary exploration of the relative importance of the different work environment dimensions.

It is important to note that, although the instructions for the standard KEYS survey instruct respondents to answer the questions by reference to their "current work environment," the instructions were customized for this validity study. Because the outcome measure to be obtained was a measure of the creativity of the work on a specific team project, respondents were told to answer the KEYS questions by reference to the work environment surrounding that particular project.

Phase 2 of the study was conducted to validate the creativity nominations of phase 1, by allowing independent expert assessments of the level of creativity in the projects nominated in phase 1. A group of experts from each of the divisions sampled in phase 1 was asked to independently rate the projects nominated from that division on creativity, quality, and their degree of familiarity with the project. These experts were kept blind to the initial nomination status of the projects, and high- and low-creativity projects were randomly intermixed in the experts' rating questionnaires. (They were asked to skip the ratings for any projects with which they were not familiar.)

Phase 3 was conducted to validate the environment assessments and creativity differences of phase 1, with a different sample, composed of individuals who were unaware of the study's purpose. In essence, it was a conceptual replication of phase 1; it was used to allow more conservative tests of Hypotheses 1 and 2 and further exploration of the relative strengths of the dimensions. We selected a subsample of projects for phase 3, because our resources did not permit us to include all projects from phase 1 in phase 3. Each team member of a project in this subsample was asked to complete a KEYS survey to describe the work environment of his or her particular project. These respondents did not know that the study concerned creativity, or that their projects had been chosen for any particular reason. Indeed, potential phase 3 respondents were eliminated if they had participated in phase 1. Each respondent in phase 3 described the environment for only one project.

Results

Phase 1: Preliminary tests of Hypotheses 1 and 2. Of those who received the initial mailings, 42 percent responded, yielding usable data on 306 projects, for a response rate of 42 percent. Discussions with high-level informants within the organization confirmed that these were primarily early-development-stage projects, often many years away from implementation. The vast majority (93%) of respondents were directly involved in the nominated projects, either as team members (58%) or as project leaders (35%) who were in many cases also team members. Most respondents were closely familiar with the projects; 62 percent reported daily involvement, and 32 percent reported weekly involvement. Moreover, most projects were remembered clearly by their nominators; fully 98 percent of the projects were rated as at least "moderately clear" in memory by their nominators.

Overall, the correlation between rated creativity and rated quality of the projects (as rated by the nominators) was substantial ($r = .57$, $p < .001$). Given our instructions to respondents, defining creativity in terms of novel *and* useful ideas, and stating that nominated projects should be those in which creativity was both possible *and desirable,* it is not surprising that low-creativity projects tended to be rated low in overall quality. However, this does not mean that project creativity and project quality were seen as merely the same thing. Although the relationship between creativity and quality accounts for 32 percent of the variance in creativity ratings, factors beyond project quality account for 68 percent of the variance in creativity.

As expected, the nominated high- and low-creativity projects were significantly different in creativity and quality, as rated by the persons who nominated the projects. On a five-point scale, the mean creativity ratings were 4.24 (s.d. = .88) for high-creativity projects and 2.58 (s.d. = 1.07) for low-creativity projects ($t_{143} = 14.86$, $p < .001$). The mean quality ratings were 4.19 (s.d. = .86) for the high-creativity projects and 3.19 (s.d. = 1.04) for the low-creativity projects ($t_{138} = 8.94$, $p < .001$).

Hypotheses 1 and 2 predict that the high- and the low-creativity projects would have substantially different perceived work environments. A multivariate analysis of variance, combining across all KEYS scales, revealed a significant difference between high- and low-creativity projects ($F_{10,\ 131} = 17.19$, $p < .001$). Moreover, as Table 3 shows, all of the KEYS scales showed significant differences in the step-down univariate analyses, in the predicted directions.

Table 3 also includes effect sizes (partial eta-squared).[3] Clearly, although high- and low-creativity projects are statistically different on all of the work environment scales, six aspects of the work environment discriminate most strongly: challenging work, organizational encouragement, work group supports, freedom, organizational impediments, and supervisory encouragement. Comparatively, sufficient resources, and especially workload pressures, show less distinction between the high- and low-creativity projects. Interestingly, earlier research using quite different methodologies (Amabile & Gryskiewicz, 1989) obtained conceptually similar results.

Several additional analyses were carried out to assess the possibility that the work environment differences observed between high- and low-creativity projects could be attributed to other project variables. There were no significant differences between high- and low-creativity projects in terms of type of project nominated (technical vs. nontechnical), project length, size of project team, organization of project team, location of project team, or

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[3] Partial eta-squared is a measure of effect size that can be interpreted as the percentage of variance accounted for; it is applicable to all F and t tests (Stevens, 1992).

TABLE 3
Phase 1 Work Environment Assessments for 141 Pairs of High- and Low-Creativity Projects[a]

KEYS Scales	Hypothesis Tested	High Creativity Mean	High Creativity s.d.	Low Creativity Mean	Low Creativity s.d.	$F(1,140)$	Partial Eta-Squared
Work environment scales							
Challenging work	1f	3.30	.52	2.66	.63	110.47***	.44
Organizational encouragement	1a	2.99	.58	2.38	.60	110.21***	.44
Work group supports	1c	3.34	.52	2.75	.62	96.12***	.41
Freedom	1d	3.10	.51	2.51	.66	90.37***	.40
Organizational impediments	2b	1.91	.54	2.46	.62	80.44***	.36
Supervisory encouragement	1b	3.10	.59	2.63	.69	60.27***	.30
Sufficient resources	1e	2.96	.57	2.65	.61	35.07***	.20
Workload pressure	2a	2.40	.56	2.55	.65	6.95**	.05
Criterion scales							
Creativity		3.09	.56	2.32	.62	165.68***	.54
Productivity		3.22	.56	2.58	.65	83.33***	.37

[a] Means are on a four-point scale, with a higher number indicating a higher level of the variable.

** $p < .01$

*** $p < .001$

nominator's role on the project (technical vs. nontechnical). Only two differences emerged on control variables. Respondents tended to report lower frequency of contact with their low-creativity projects ($t_{144} = 5.08$, $p < .001$), and they tended to report recalling the high-creativity projects better ($t_{138} = 4.60$, $p < .001$). Because these differences may have affected perceptions of the work environment, the MANOVA on the KEYS scales was repeated twice, once covarying contact frequency and once covarying clarity of recall. Neither factor was a significant covariate, and the work environment differences between high- and low-creativity projects were still obtained.

Thus, phase 1 provided strong support for Hypotheses 1 and 2.

Phase 2: Validation with independent assessments of creativity. The primary purpose of phase 2 was to validate the creativity nominations from phase 1; it is important to show that the obtained work environment differences apply to projects that are truly different in creativity. For this reason, we included in our phase 2 analysis only projects that had been rated by three or more experts. This procedure yielded a total of 94 rated projects from the three divisions that could be sampled in this phase.

Like the phase 1 respondents who nominated these projects, the expert raters from phase 2 viewed the projects' quality and creativity as highly related ($r = .68$, $p < .001$). Because different raters rated different subsets of projects, we assessed the reliability of the expert creativity assessments using intraclass correlation (ICC).[4] This statistic indicated a modest degree of consistency between raters ($ICC_{1,k}$ = .58). Despite the relatively low reliability of these creativity ratings, projects that had been nominated in phase 1 as high-creativity were still found to be significantly higher in expert-rated creativity than those that had been nominated as low-creativity projects ($t_{92} = 3.42$, $p < .001$). This finding supports the creativity nominations of phase 1.

Phase 3: Additional tests of Hypotheses 1 and 2. Only projects that had been assessed by at least three phase 2 raters were included in phase 3. We also required that the raters' familiarity ratings average at least 3.0 (midpoint on the scale). Then, to ensure selection of only truly high- and low-creativity projects, we eliminated those with an average expert-rated creativity score within 1 standard deviation of the mean (1/2 standard deviation on each side). Finally, we removed a few projects with mean phase 2 ratings falling into the high-creativity category if they were originally nominated as low-creativity in phase 1, and vice versa.

This procedure yielded 36 projects (18 high-creativity and 18 low-creativity). The level of agreement between the phase 2 expert creativity ratings on these 36 projects was quite acceptable ($ICC_{1,k}$ = .76). Of the 36 project leaders, 24 provided names of all project team members who were still with the company. All of those project members (except two who had previously participated in phase 1) were then asked to complete a KEYS to describe the work environment surrounding that project. Because one of these projects was rated by only one phase 3 respondent, the final number of phase 3 projects was 23 (12 high-creativity and 11 low-creativity).

Of the 250 project team members who received phase 3 packets, 170 (68%) returned usable questionnaires. Of these, 95 percent reported that they could recall the project environment at least moderately clearly. In addition, the majority of respondents (78%) reported daily involvement with the rated project.

Interrater reliabilities were computed on KEYS for each project assessed in phase 3, using data from both the original project nominator (from phase 1) and the raters in phase 3. Cronbach's alpha was used to assess the reliability of the mean work environment ratings for each project. Overall, the reliabilities of the environment perceptions were acceptable (median = .75), with alphas ranging from .21 to .93, and with generally higher reliabilities for the high-creativity projects. It is possible that these very advantageous work environments are more salient and consistent, and thus they are more uniformly perceived by those who work in them. Over both high- and low-creativity projects, however, the alphas are sufficient to allow acceptance of the mean of the ratings from a given project team's members as a fairly reliable estimate of the work environment of the project.[5]

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[4] When each target is rated by a different set of k judges and their ratings will be averaged, as in phase 2, a one-way analysis of variance (ANOVA) is used to estimate the variance of interest and error; the appropriate formula is $ICC_{1,k} = (BMS - WMS)/BMS$ (Bartko, 1966; Shrout & Fliess, 1979; BMS = between-mean-square, WMS = within-mean-square).

Our central prediction was that the perceived project environments of the high- and the low-creativity projects would differ, in the same directions found in phase 1. Table 4 presents the results of this analysis, which support our hypotheses for most of the KEYS scales.[6] The high-creativity project environments were higher on the creativity stimulant scales of work group supports, challenging work, organizational encouragement, and supervisory encouragement. Additionally, the freedom scale was marginally higher for high-creativity projects. Low-creativity projects, in contrast, were rated as higher on the creativity obstacle scale of organizational impediments. No differences were found for the workload pressure and sufficient resources scales. Also as expected, both criterion scales (creativity and productivity) were significantly higher for the high-creativity project environments. As was found in phase 1, these two criterion scales were highly correlated ($r = .61$, $p < .001$).

Because recall clarity and frequency of contact with the project were related to creativity level in the phase 1 data, we repeated this analysis covarying for these factors. Neither variable was a significant covariate, and the work environment differences originally observed were still obtained.

Phase 3 was intended as a conceptual replication of phase 1, with multiple independent raters who were unaware that the study concerned creativity and rated only one project, rather than contrasting two projects. Thus, it is essential to examine the correspondence between phase 1 and phase 3 data. Figure 2 shows that, in nearly all respects, the phase 3 results mirror those of phase 1. The primary difference is that the phase 3 results are less powerful; overall, the separation between the high- and low-creativity projects is smaller.

Thus, phase 3 partially supports Hypotheses 1 and 2. Specifically, it supports Hypotheses 1a (organizational encouragement, 1b (supervisory encouragement), 1c (work group supports), 1f (challenge), and 2b (organizational impediments). It does not support Hypotheses 1e (sufficient resources), 2a (workload pressure), and 1d (freedom).

Discussion

Overall, this study provides important construct validity information on KEYS and supports the conceptual model presented in Figure 1. High-creativity projects were generally rated higher on the KEYS scales proposed

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[5] When the phase 3 analyses are repeated with only those 15 projects having interrater reliabilities above .70 (6 low-creativity and 9 high-creativity), the results are completely consistent with those reported in Table 3 and are, in fact, somewhat stronger.

[6] Although the overall multivariate *F* was not statistically significant, we proceeded with the individual planned comparison tests for each KEYS scale. According to both Hays (1981) and Stevens (1992), previously planned comparisons with an empirical or theoretical basis should be carried out, even when the effect of an overall ANOVA is not significant.

TABLE 4
Phase 3 Work Environment Assessments for 12 High-Creativity and 11 Low-Creativity Projects[a]

KEYS Scales	Hypothesis Tested	High Creativity Mean	High Creativity s.d.	Low Creativity Mean	Low Creativity s.d.	$F(1,140)$	Partial Eta-Squared
Work environment scales							
Work group supports	1c	3.30	.31	2.94	.26	9.12**	.30
Challenging work	1f	3.25	.22	2.87	.43	7.05*	.25
Organizational encouragement	1a	2.83	.33	2.51	.26	6.55*	.24
Supervisory encouragement	1b	3.12	.42	2.78	.34	4.54*	.18
Organizational impediments	2b	2.05	.37	2.32	.28	$3.83^{\dagger}$	.15
Freedom	1d	2.94	.30	2.72	.38	$2.38^{\ddagger}$	.10
Workload pressure	2a	2.52	.19	2.62	.40	.71	.03
Sufficient resources	1e	2.83	.33	2.78	.33	.10	.00
Criterion scales							
Creativity		2.89	.28	2.60	.27	6.43*	.23
Productivity		3.02	.33	2.72	.32	4.94*	.19

[a] Means are on a four-point scale, with a higher number indicating a higher level of the variable.

* $p < .05$

** $p < .01$

$^{\dagger}p = .06$

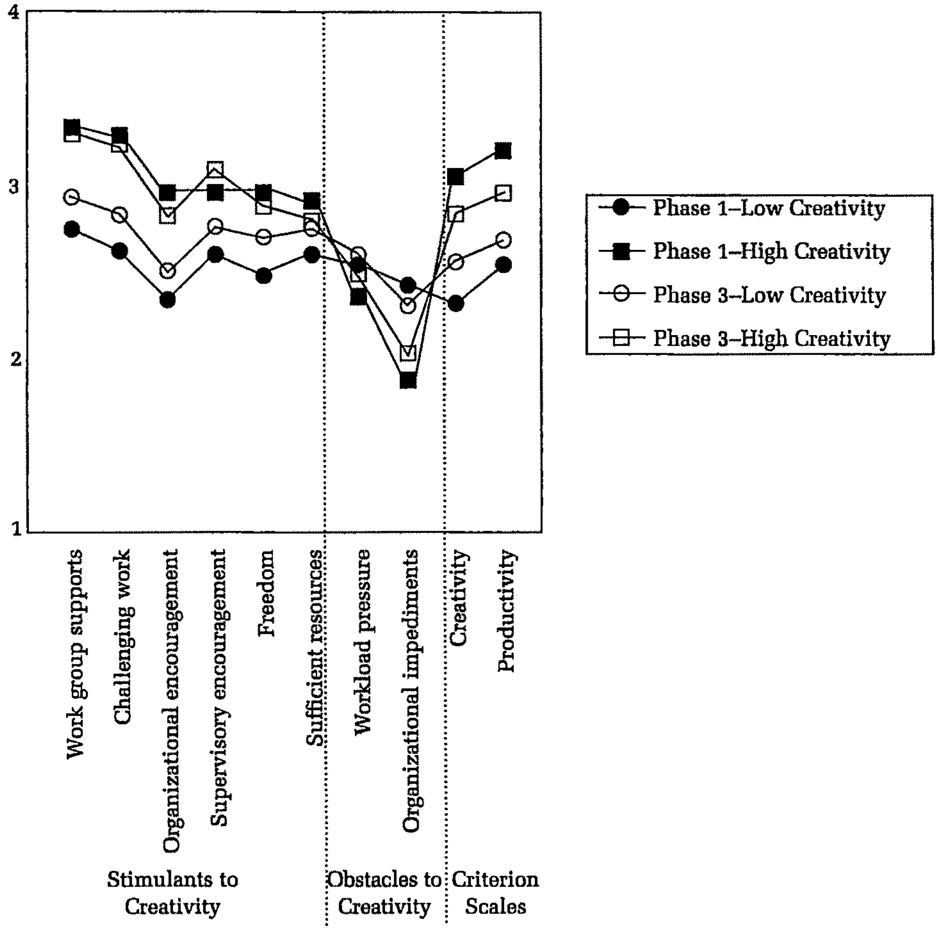
$^{\ddagger}p = .15$

as stimulants to creativity and lower on the KEYS scales proposed as obstacles to creativity. These findings were bolstered by independent creativity assessments by internal company experts and by independent work environment assessments by various project team members.

This validity study is useful in a number of ways. It is the first study to obtain independent quantitative measures of the work environment from several respondents in each work environment and separate independent quantitative measures of the creativity of the work being done in those environments. Moreover, the findings of the study are applicable to both technical and nontechnical work; no clear differences were found between the two categories of projects. Additionally, the study demonstrates that work environment perceptions can be aggregated across different respondents within the same environment.

However, some cautions apply to the interpretation of the results of this validity study. Because the outcome measure was work produced by a project team, and because the work environment perception measures were aggregated at the level of the team, the results are only directly generalizable at that level. Although it is reasonable to assume that KEYS measures aggregated at other levels, such as departments, should be similarly related to

FIGURE 2
Work Environments of High- and Low-Creativity Projects



creativity measures at those levels, such applicability will require further research for confirmation.

Importantly, causal interpretations cannot be drawn from this observational study. It is true that many of the findings in this study match well with the results of research reviewed earlier and with the results of experimental studies in which environment has been manipulated (e.g., Amabile, 1983). Nonetheless, it may well be the case that at least some of the work environment factors studied here are *consequences* of the level of project creativity, rather than causes. Indeed, it is likely that a complex causality accounts for variations in project creativity and project work environment, whereby the nature of the work and the nature of the work environment are both causes and consequences in a complex chain of feedback loops.

Caution is also warranted in view of the modest response rates in the validation study. It is possible that the respondents were the most innovative or committed members of the organization. If this were the case, however, the consequence might be constrained variance, leading to a conservative test of our hypotheses. It is also possible that these individuals have different perceptions of creative work environments and creative projects; however, it may well be the perceptions of the most innovative organizational members with which researchers should be most concerned.

Additionally, a number of biases might have been operating in this study. *Memory biases* could have entered in, particularly for the phase 3 respondents. Nearly half of all projects nominated in phase 1 were currently ongoing (and virtually all had been conducted in the previous three years), but an additional nine months passed before the phase 3 respondents made their ratings. Thus, it is possible that clouded recollections somewhat compromised accuracy of reporting. This may partially account for the relatively weaker effects in phase 3. Of course, it is also possible that the work environments of ongoing projects actually changed in the nine months.

Several other potential biases were at least partially addressed in the research design. Although *idiosyncrasy biases* might have entered into phase 1, in which a single individual identified and described projects that he or she personally saw as high or low in creativity, such biases were counteracted by the independent creativity assessments of phase 2 and the independent work environment assessments of phase 3. In addition, *respondent biases* might have been operating in phase 1. Because phase 1 respondents were asked to recall their highest-creativity and their lowest-creativity projects, they likely made implicit comparisons between these projects as they completed the two KEYS surveys. As a result, their responses may have been tainted by their preconceived notions of what contributes to a high- or low-creativity environment. However, this bias is much less likely to have occurred in phase 3, where respondents filled out a KEYS for only one project, without knowing that the study concerned creativity. Similarly, we attempted to overcome *common method bias* by using an entirely different data collection tool in phase 2, as well as different instructions for KEYS in phases 1 and 3.

However, one bias is potentially more problematic. A *halo effect* might have been operating, leading individual respondents in the study to rate "good" projects favorably and "poor" projects unfavorably on all dimensions, without discriminating among different aspects of project environments or project outcomes. If this were the case, then we would not be able to say confidently that the KEYS scales assess specific aspects of the work environment for creativity and only for creativity. Indeed, there were substantial intercorrelations between some of the KEYS scales (as is always the case with KEYS), and ratings of the creativity and the quality of the nominated projects correlated strongly. For several reasons, however, it is unlikely that simple halo effects account for all the obtained results. First, there were considerable differences between scales in the effect sizes of differences between high- and low-creativity projects. Thus, it appears that respondents were not simply responding uniformly to all of the items. Second, different individuals participated in each of the three phases. Halo effects have been documented in the social psychology literature for individuals; it is less likely that a mass halo effect was operating, leading the different project members in phases 1 and 3 and the independent experts in phase 2 to all respond in the same biased way. Third, given that these were early-development projects, the ultimate success of most projects was not known at the time of any of the data collections.

Clearly, it is still possible that some general halo effects were operating. Given the design of the study, we cannot definitively state that the KEYS scales assess the work environment only for creativity. However, it would be unreasonable to expect that work environment factors relevant for creativity would be completely irrelevant for other aspects of work. We suggest only that the instrument will be useful if its scales tap aspects of the environment that are particularly relevant for creativity—even though they may be relevant for other work outcomes, as well.

CONCLUSIONS

KEYS can be useful in future research and theory development in organizational creativity by providing scholars with a psychometrically sound tool for quantitatively assessing the perceived work environment for creativity. This tool can be profitably used in conjunction with interviews and other questionnaires, as has been done in recent research (e.g., Amabile & Conti, 1994). Whether used alone or with other methods, this instrument and the model upon which it is based give researchers a way to seriously turn their attention toward creativity in organizations, which is the root of innovation. Rather than focusing on the personality characteristics that dominated earlier psychological research on creativity, or the organizational structures for implementation that have dominated organizational studies of innovation, the present approach highlights the psychological context of innovation—the work environment perceptions that can influence the level of creative behavior displayed in the generation and early development of new products and processes. Creative ideas from individuals and teams within organizations sow the seeds of successful innovation; scholars of innovation must seriously consider characteristics of the organizational context that can impede or support the generation of those ideas.

The research reported here suggests several directions for future research. One of the most important results of the validation study concerns the differential strength of different work environment dimensions. The study allows for a reasonably confident assertion that perceptions of five work environment dimensions do consistently differ between high- and low-creativity projects, and thus these dimensions may play an important role in influencing creative behavior in organizations: challenge, organizational encouragement, work group supports, supervisory encouragement, and organizational impediments. Notably, three of these five dimensions have not appeared prominently in previous research or theory: challenge, work group supports, and organizational impediments. The relative lack of attention to these dimensions is particularly surprising, because challenge and work group supports showed the highest effect sizes in both phase 1 and phase 3. Perhaps just as surprising, the study suggests that three other dimensions may play a less prominent role in organizational creativity: resources, workload pressures, and freedom. Two of these, freedom (autonomy) and resources, have been mentioned frequently in the literature. Although the freedom results were strong in phase 1 and weak in phase 3, the resources and workload pressures results were weak in both phases 1 and 3. Finally, our results confirmed the prominence given to two dimensions in previous work: organizational encouragement and supervisory encouragement. Future research should be directed toward replicating and elaborating the differential impact of different work environment dimensions.

Additional construct validity studies are needed, such as (1) studies in which different individuals, such as outside observers, are responsible for initial identification of high- and low-creativity projects, (2) studies of projects in which creativity and quality might be more clearly separable, (3) studies in different types of organizations, and with a wider variety of project types, and (4) predictive validity studies, in which the work environment assessed at one point in time can be used to predict the creativity of work outcomes at some later point in time. Such studies should use a variety of methods, in combination with KEYS, to focus specifically on both the unexpectedly weaker dimensions in the current study (freedom, resources, and workload pressure), and the unexpectedly stronger dimensions (challenge, work group supports, and organizational impediments).

The study at High-Tech Electronics validated KEYS at the level of team project creativity and perceived project team work environment. Like many researchers (e.g., Ancona & Caldwell, 1992), we consider studies at this level particularly useful both theoretically and practically. However, KEYS should be applicable beyond this level. Because KEYS assesses psychological perceptions of the work environment, regardless of the level within an organization at which influences on those perceptions arise, the instrument should be applicable at the level of departments, divisions, or even small organizations—as long as the individual respondents perceive themselves to be working within the same environment. Such research would require aggregating responses at those levels and, importantly, it would require meaningful, reliable measures of the creativity of the work being produced at those levels. Although greater variabilities in work environments assessed at broader levels would increase the error variance in these studies, it should still be possible to find differences in the same direction as those discovered at the project level.

Ultimately, research should be directed toward discovering the precise connections between particular events in individuals' work experience and their resulting perceptions of the work environment. From the present results, it appears that people will produce more creative work when they perceive, for example, that management is encouraging them to solve problems creatively. The challenge for future research will be to determine the specific managerial behaviors and other events within (and outside of) their organizations that lead people to perceive such encouragement. Such findings would be important not only for theory development but also for application to managerial practice.

KEYS has potentially broad applicability in organizations. It can be used not only to diagnose the relative degree to which an organization's work environment fosters creative work, but also to assess the effectiveness of environmental improvement efforts. As a part of its diagnostic function, it can specify particular areas of a work environment that are relatively strong or weak at a given point in time, helping managers and organizational leaders to identify directions for action. For example, if a given department scores particularly low on the challenge dimension, that department's manager might pay greater attention to appropriately matching employees to projects so that, whatever their skill level, they feel challenged by and interested in assigned projects.

Perhaps the most important lesson for management from the results of our KEYS research is that the perceived work environment does make a difference in the level of creativity in organizations. Managers at all levels who wish to foster creativity and innovation within their organizations can do so not only by paying attention to what sort of individuals they hire—to the kind of personal characteristics and skills that early creativity research emphasized—but also by paying attention to the environments they create for these potentially creative individuals.

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GENERATIONAL TECHNOLOGICAL CHANGE: EFFECTS OF INNOVATION AND LOCAL RIVALRY ON PERFORMANCE

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We tested the effects of innovation and market complexity on firm performance. Generational technological change—a major advance within a technology regime—fosters the emergence of niches and local rivalry. Findings from the U.S. microcomputer industry between 1982 and 1991 suggest accelerated markets reward innovativeness that differentiates firms within a niche but not across niches. Changing niches confers a short-term penalty. Strong performers adopt new technology quickly, without changing niches.

One of the liveliest streams of organizational research in recent years concerns how managers cope with rapid technological change. Observing frequent innovation in the fastest-growing sectors of the global economy, scholars are responding with new theory. Punctuated equilibrium models (Gersick, 1991) dominate current thinking about organizational and environmental change. They capture well what happens over extended periods of time: abrupt and revolutionary transformations interrupt eras of incremental change. However, the relatively long intervals between discontinuities are less placid than they might appear. In innovation-intensive sectors, in fact, they can be quite turbulent.

The personal computer (PC) industry typifies this sort of organizational domain. At a high level of abstraction, it has been characterized by stable technology and incremental change. Through the lens of punctuated equilibrium, two discontinuities have marked the evolution of PCs. The first low-cost microcomputer (a computer in which a microprocessor chip is the central processing unit) debuted in 1975. For the next six years, the industry grew rapidly, as new entrants introduced a variety of incompatible machines. In 1981, a new period began when IBM introduced an architecture that quickly dominated the industry.

This standard, which revolves around Intel microprocessors and the

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DOS operating system, has not been challenged significantly in 15 years. Yet the pace of innovation has been extremely rapid, and the population of microcomputer makers has changed dramatically. Only two of IBM's chief rivals in 1981, Compaq and Apple, have successfully navigated these changes to remain significant competitors. Today, scores of computer makers offer models that feature an eclectic array of technologies and price points (relative prices across a product line).

Scholars know much more about the way organizations operate in accelerated markets, like the one for personal computers, than they did a decade ago. In this realm in which change is so rapid that it seems nearly continuous, speed and movement are strategic imperatives. Firms adapt through a complex interaction of short-term and long-term pacing events (Gersick, 1994). Short innovation cycles and quick adaptation are pivotal (Eisenhardt, 1989; Galunic & Eisenhardt, 1996). Competences sometimes shift in unexpected ways as internal selection environments interact with fast-moving external environments (Burgelman, 1994). Managers employ compression tactics and iterative learning to increase the speed of organizational processes (Eisenhardt & Tabrizi, 1995). Our article enlarges on this growing stream of research on an emerging, important kind of environment.

We contribute first by exploring in greater depth how rapid innovation within a seemingly stable technology regime creates complex competitive conditions. More than 30 years ago, Emery and Trist (1965) called for deeper analysis of turbulent fields, organizational domains characterized by accelerated change and complexity of interactive effects. Building on their work, Terreberry (1968) suggested that turbulent environments tend to evolve to more complex states. In her view, this process happens because the most important components of a firm's environment are other organizations.

We examine how a certain type of rapid innovation creates a complex mosaic of relationships among firms. First, we describe *generational technological change,* an evolutionary force that has received slight attention in the punctuated equilibrium literature. Such change occurs when big advances are made within a technology regime. It drives the evolution of a complex market structure because new generations of a technology do not eliminate older ones. When newer and older generations coexist at different price points, firms have a broad range of opportunities to specialize or to become different kinds of generalists.

We then explore how generational change and the accompanying evolution of niches, or firm positions in a product-market space, influence firm performance. We contrast three effects on performance: a firm's maneuvering among generations and niches, the characteristics of its focal niche, and the characteristics of other niches. We conclude that in general, under conditions of fast-paced innovation, performance depends more on the way firms maneuver with respect to *local rivals* (competitors within a niche) than on finding and occupying a favorable niche.

THEORY AND HYPOTHESES

Innovation as Generational Technological Change

Technological innovation is commonly studied through the lens of the life cycle, which emphasizes either radical or incremental change (Dewar & Dutton, 1986). Many models of technology evolution focus on these two categories (Dosi, 1982; Sahal, 1985), although radical change in particular has captured the attention of management scholars. Rosenbloom and Christensen (1994) surveyed a number of definitions and settled on Dosi's notion that radical change "redefines the very meaning of progress." In Schumpeterian terms, radical change surges through a market, overturning some capabilities and in many cases sweeping incumbents away (e.g., Cooper & Schendel, 1976). An era of ferment typically follows radical change. The market, like the previously dominant technology, is disrupted. Entries, exits, product introductions, and other competitive shifts multiply.

Stability eventually returns to the market, however. Technology changes incrementally, following an orderly pattern that resembles normal science (incremental discoveries within a paradigm) (Anderson & Tushman, 1990). Although the cumulative effects of incremental changes may be important, individual advances are almost invisible because their effects are so small (Hollander, 1965). Dosi (1982) called a time of normal, incremental innovation a *technology regime.*

Like most punctuated equilibrium models, the technology life-cycle model is meant to explain broad patterns of change on an historical time scale. In accelerated markets, however, innovation within a technology regime may significantly affect organizations' life chances. For example, Henderson and Clark (1989) documented how a series of architectural changes within the regime of x-ray etching caused leadership of the semiconductor photolithography industry to change hands time and again. Incumbents dismissed each generational shift as a mere extension of existing technology. In a broad sense, the technology was stable. For two decades, firms simply refined techniques for etching semiconductors. The generational shifts studied by Henderson and Clark are not discontinuities, but neither are they simply ripples in a placid environment.

We define generational technological change as a significant advance in technical performance within a technology regime. It is a type of innovation that occurs within what are usually thought of as periods of incremental change. It has an interesting feature with important competitive implications: new generations of technology do not necessarily overwhelm preceding generations. Generational technological changes are backward compatible, so older technology remains valuable to some customers. Because of this continuity, such change is quite different from radical technological change. Although discontinuous advances may build on the existing skill sets of incumbents (Tushman & Anderson, 1986), they almost always displace their predecessors fairly rapidly. For instance, once computers with integrated circuits appeared, few customers wanted computers with vacuum tubes. Once digital fax machines diffused, few customers wanted the old analog technology. In contrast, when a new generation appears *within* a technology regime, different technology vintages can coexist at different price points.

The U.S. microcomputer market provides an example of generational technological change. The original IBM PC, introduced in 1981, was based on the Intel 8088 central processing unit. Microcomputers driven by the Intel 80286 were introduced in 1982, and computing power increased four times in a generation. In 1986, Compaq beat IBM to market with a computer based on the Intel 80386 microprocessor, more powerful by about six times than the previous generation. In 1989, Intel released the 80486, a chip ten times more powerful than the 80386.

Despite substantial technical differences, each of these generations was compatible with earlier ones within the technology regime defined by Intel microprocessors and Microsoft operating systems. Even today, each continues to hold a share of the computer market, and some even complement the others. For example, older technology may become attractive at the entry level because some customers—first-time buyers, for example—prefer lower-priced, if less powerful, personal computers. They can also see a clear upgrade path under an umbrella of compatibility. Older technology is displaced gradually as prices of the new-generation products reach parity with the prices of older products. Meanwhile, the newest technology generation gives sophisticated users powerful and expensive options. The market for new computers grows when low prices broaden the number of customers who adopt the standard, producing positive network externalities (Katz & Shapiro, 1986).

Generational technological change poses two distinct challenges for firms. First, incumbents face the decisions of whether and when to adopt the new generation (Mitchell, 1989). They must also choose whether to "generalize," offering a product line that spans several generations, or specialize in one. Second, a wave of new models and price changes shifts the competitive mosaic. New niches may open up, existing niches may close down, and competitors may reposition themselves. When a new generation emerges without displacing older ones, there is a wide set of possible configurations into which producers can settle.

Generational Technological Change and Niche Evolution

Generational technological change makes markets highly complex. When the first generation of a technology reaches the market, a firm has only two choices: it either makes a product with the available technology, or it stays on the sidelines. As newer generations emerge, and earlier ones continue to sell at lower prices, customers have many model choices, and firms have a broad set of feasible strategies. When a second generation appears, a firm can specialize in generation one, specialize in generation two, using a strategy based on higher prices and performance, or become a generalist spanning both. Further, generalists can make different choices about product line and pricing in order to segment the market and avoid cannibalization (sales decline in the older generation; Mitchell & Singh, 1993). Different price points are just the start of the options available in the contemporary PC market, so customers are more heterogeneous, too. The number and kind of niches that firms can conceivably occupy increase.

Like Swaminathan and Delacroix (1991), we defined a niche as a position in product-market space. However, we agree with Terreberry's (1968) notion that the most important elements of an organization's environment are other formal organizations. Therefore, we describe a niche in terms of a group of firms with similar posture toward innovation, product lines, and pricing, as we detail later in the Methods section.

In our view, a product category in itself is not a niche. This position contrasts with some others. Swaminathan and Delacroix (1991), for example, distinguished the product category "table wine" as a niche within the wine industry as a whole. Instead, we would define the set of firms that specialize in producing table wines as members of the same niche, as long as they sell at comparable price points. Alternatively, there might be different niches occupied by firms that specialize in either premium or low-priced wines. We would place the set of broad generalists whose product lines include table, dessert, and fortified wines in a different niche.

We also depart somewhat from the standard definition in organizational ecology, the branch of organization theory that contains the most extensive scholarship on niches. Hannan and Freeman (1989: 96) used Hutchinson's (1959) definition of niche as a multidimensional space formed by the set of points for which a population's growth rate is nonnegative. However, organizational ecologists do not really use this definition operationally because such a "hypervolume" might have thousands of different dimensions. Conceivably, growth rates depend on a population's position in key labor markets, its political standing, and so forth. By limiting ourselves to product markets, we adopt a view closer to that of Elton (1927), who defined a niche as a population's way of earning a living, its place in the community to which it belongs.

Our interest in technology-driven niches builds on a growing body of research into differences within a market or a population (Baum & Singh, 1994). Levinthal (1991) showed that heterogeneity within organizational populations is considerable; subpopulations may have quite different vital rates. Lomi (1995) demonstrated that the population of banks that he studied was internally differentiated and that different segments responded heterogeneously to legitimization and competition. Eisenhardt and Schoonhoven (1990) found that a semiconductor firm's fate and growth rate depended a great deal on whether it was entering an emerging, growing, or mature market niche. Swaminathan and Delacroix (1991) discovered that organizations in a sheltered niche had lower failure rates than the population as a whole.

How have market subpopulations been identified? Empirical analysis of niches in the organizational ecology literature has typically relied on organization size to distinguish one niche from another. Baum (1996) reviewed a number of studies that examine how size-localized competition affects mortality. Amburgey, Dacin, and Kelly (1994), in a study of credit unions, suggested that size-localized selection accounts for the emergence and maintenance of strategic groups. Other analysis has focused on the degree to which firms' customer or supplier demography overlaps. Baum and Singh (1994), for instance, measured the degree to which child care organizations operated in overlapping regions serving similar age groups. Wholey and Huonker (1993) gauged niche overlap as the number of funding sources and services common to two agencies.

Because a firm's way of making a living has many different aspects, we doubt there is one best way to identify a niche empirically. We chose to focus on technology instead of organizational size or customer demography because technological change is such a powerful evolutionary force in accelerated, innovation-intensive markets. Generational change interests us because it drives competitive markets toward increasing complexity. It expands the range of ways in which firms can differentiate from one another, sorting themselves into various categories of specialism and generalism. This dynamic affects firms' maneuvering and positioning with respect to each other.

A focus on firms' similarity in product-market space distinguishes our approach from another research stream on substructures within industries: the strategic groups literature. An offshoot of industrial organization economics, it seeks to explain profitability differences among firms. Theorists in this area argue that profit differentials depend not only on firm and industry characteristics, but also on the pattern of substructures within an industry (Dranove, Peteraf, & Shanley, 1993). They are principally concerned with the relationship between group membership and firm performance (Cool & Dierickx, 1993). Porter (1979) suggested that mobility barriers (Caves & Porter, 1977) explain why some groups of firms have persistently higher profits than others. Similar performance is also attributed to strategic group members as another consequence of mobility barriers.

However, Lawless and Finch Tegarden (1991) argued that differences among markets, and idiosyncratic firm characteristics, account for some persistent performance variance, even among firms in the same strategic group. Dranove and colleagues (1993) pointed out that profit differences cannot depend on the mere existence of mobility barriers. They must enable some form of coordinated behavior, such as collusion or knowledge sharing, in order to affect profits. Peteraf and Shanley (1994) argued that strategic groups emerge only when their members develop a shared identity, a collectively held social construction arising out of firms' interactions.

Our niches are occupied by firms that are similar to one another but do not necessarily constitute strategic groups in any of the customary respects. We do not presuppose the existence of mobility barriers, so we impose no prior constraints on the rate at which firms change niches. We do not propose that the managements of firms in a niche coordinate their behavior consciously or that the firms share a collectively held social identity. We also do not assume that firms in the same niche make the same sorts of strategic choices. Scholars who study strategic groups typically partition industries into clusters of firms that follow similar strategies over time (Fiegenbaum, Sudharshan, & Thomas, 1987), or whose performance is similar. In contrast, we suggest that firms within a niche profit asymmetrically when they differentiate themselves from others in the same niche.

The evolution of industry substructures is not well developed in the strategic groups literature. For one thing, researchers have had little access to methods that allow longitudinal studies of clusters of firms. However, they also impose the assumption that group members follow similar strategies. Fiegenbaum and colleagues (1987) argued that to study groups of firms that make similar strategic decisions over time, empirical analysis must focus on "strategically stable time periods," during which the average behavior of firms remains relatively unchanged and the underlying strategic variables are more or less the same. Such stability occurs seldom, if at all, in accelerated, innovation-intensive markets. By focusing only on similarity in product-market space, we are able to study the impact of maneuvering within and among niches during periods in which the average behavior of firms evolves quite rapidly. This is important in competition because strategies that work in static environments may backfire in dynamic ones (Lumpkin & Dess, 1995).

To summarize, we studied the impact on firms' performance of evolving complexity in an innovation-intensive market characterized by generational technological change. A number of factors influence organizational outcomes in such markets. We focus on three: (1) strategic maneuvering against a background of shifting niches, (2) characteristics of the niche a firm occupies, and (3) characteristics of the other niches in the market. The third of these, cross-niche effects, is a complex factor whose thorough exploration requires another article. Here, we limit ourselves to examining only the most basic demographic characteristics of niches other than the focal niche.

Strategic Maneuvering: Innovation, Local Rivalry, and Niche Switching

When a new generation of technology is introduced, firms face two key strategic decisions—whether and when to adopt the innovation (Mitchell, 1989). We suggest that one consideration for such firms is that they may incur a penalty for delaying innovation. An innovation imperative must be one of the priorities of firms in accelerated markets. It is simply not a viable option to ignore new technology altogether. Returns to innovation are traditionally modeled as a function of entry order, with early adopters outperforming later ones (Kerin et al., 1992). Thus,

> *Hypothesis 1: The faster a firm adopts a new generation of technology, the stronger its performance.*

Additionally, however, the competitive impact of adopting an innovation depends on timing relative to other firms'. A firm benefits from adopting newer generations of technology to the extent that it is differentiated within its niche. What matters most is its position with respect to local rivals, since they offer similar technology vintages at similar prices. Those adopting new technologies before their local rivals may capture a variety of benefits. The degree of first-mover advantage depends on the extent to which an innovation sets a firm apart from local rivals, even if it is not an early adopter with respect to the population as a whole.

> *Hypothesis 2: A firm's performance is stronger the greater the proportion of local rivals that are at least one technology generation behind it.*

On the other hand, advantages from moving early need not be symmetrical with disadvantages of moving late. It may be that firms gain little from leading, but pay a stiff penalty for falling behind, or vice versa.

> *Hypothesis 3: A firm's performance is weaker the greater the proportion of local rivals that are at least one technology generation ahead of it.*

Strategic maneuvering is not limited to the question of whether and when to adopt new technology. Under generational technological change, a population's niches are a shifting mosaic. Local rivals generate ecological pressures on each other because they increase density within a resource space, whether or not managers intend to compete more fiercely with the firms that are most similar to their own. The competition we expected among local rivals stems from their similarity. Ecological theory and empirical results suggest that organizations with similar resource requirements compete more intensely (Baum & Mezias, 1992). For example, in the beer industry, national brewers compete with other national brewers, and local brewers compete with others in the same area, even though local and national brewers have modestly symbiotic effects on one another (Boeker, 1991). Similarly, mutual telephone companies compete with other mutual telephone companies in the same geographic area, though their relationships with commercial telephone companies are symbiotic (Barnett & Carroll, 1987). The timing of an innovation therefore matters if it differentiates a firm from others in its niche.

More intense competition among local rivals is another respect in which our model diverges sharply from strategic group theory. (Others, discussed above, include the presumption of mobility barriers, similar strategies, and performance within groups and a focus on periods of stable conduct.) In orthodox strategic management thought, similar firms have an easier time and reap greater rewards if they cooperate (Oster, 1994), even if the cooperation is tacit. Porter (1985) concluded that low "strategic distance" increased firms' appreciation of their common interests and facilitated implicit or explicit collusion. Zajac and Jones (1987) described a set of ideal conditions for cooperation within a strategic group and included minimum distance among the firms in the group as one of them.

Instead, we find merit in the proposition that competition is strongest among firms that occupy similar positions in resource space, so it will be more intense within niches. Conceptually, identical firms face perfect competition. Where similarity is imposed on all by common niche conditions, firms learn that performance depends on the ability to differentiate where they can. They maneuver away from direct competition through distinctive technology, products, and pricing. Rumelt (1984) argued that above-normal profits are based on differentiation that is hard to imitate, even among firms with similar initial endowments. Lawless, Bergh, and Wilsted (1989) found evidence of idiosyncratic firm differences among group members that were in other ways similar. Cool and Dierickx's (1993) study of the pharmaceutical industry is exceptional in the strategic groups literature because it offers evidence of both within-group and between-groups rivalry. We expect that differentiation matters most within a niche; strong performers distance themselves in resource space as much as they can from local rivals.

Some empirical evidence hints that firms might not benefit from behaving in ways that differ from group norms. Chen and Hambrick (1995), for example, divided 28 airlines into two subgroups based on size. They found that in some instances, behaviors significantly higher or lower than the group average were negatively correlated with performance. However, they grouped firms on the basis of size, not product market. Their study examined deviations from group norms, such as propensity for action, not distances within a resource space. We therefore suggest that firms facing generational technological change not only must choose when to adopt a new technology, but also must use price and technology to maneuver themselves with respect to local rivals.

> *Hypothesis 4: The greater a firm's average distance in resource space from others in the same niche, the stronger its performance.*

Such maneuvering can, however, be a delicate balancing act. Firms may choose actions that not only distance themselves from others in a niche, but that also cause them to switch from one niche to another. For example, a low-end specialist may adopt a new technology generation well before other low-end specialists, only to find that it now competes with low-end generalists and high-end specialists. Similarly, a broad generalist with premium products may cut prices to differentiate itself from rivals only to find that it is now in a different niche, populated by low-price generalists who compete on cost. Further, firms may switch niches because they do not change quickly enough. For example, a high-end specialist that delays adopting a new generation of technology may switch into a medium or low-end specialist niche simply as a result of inaction.

Even in accelerated markets, therefore, the decision rule to "always be innovative" is too simple. It may carry a penalty of poor performance relative to that of rivals who do not move. Changing niches is costly, at least in the short run (Barnett, 1994). Huff, Huff, and Thomas (1994) diagnosed failure to move in terms of the stress of strategic change. In their study of change in the

Finnish newspaper industry, Amburgey, Kelly, and Barnett (1993) found an effect similar to the penalty we describe. Barnett and Carroll (1995) reviewed studies linking change and mortality and suggested that the general effect of change—an immediate spike in the hazards organizations face—declines over time. Although we did not examine mortality, we expected similar short-run effects of niche changing on performance. Firms that switch niches may incur a variety of costs, such as loss of valuable niche-specific experience, increased uncertainty in a new environment, and costly investment in new capabilities. In the long run, a change may be hazardous or helpful (Haveman, 1992), or simply cosmetic (Delacroix & Swaminathan, 1991). In the short run, we suggest that niche switching is costly. Thus,

> *Hypothesis 5: Relative to firms that stay in the same niche, firms that change niches have weaker performance in the short term.*

The longer-run effects of staying in the same niche are more difficult to predict. On the one hand, the longer a firm accumulates experience in a particular niche, the more it can reduce uncertainty by learning about customers and rivals (Lave & Wenger, 1991), and the more it can develop valuable, specialized assets (Ghemawat, 1991). A considerable body of evidence from organizational ecology suggests that mortality rates decline with age, and changes reset mortality clocks (Amburgey et al., 1993). The longer a firm's experience in its niche, the stronger its performance. On the other hand, experience may be a liability in fast-paced environments (Aldrich & Auster, 1986). To unlearn obsolete responses can be as rewarding as to accumulate experience (Levinthal & March, 1993). Firms that never change niches avoid the short-term penalty of niche switching, but they may be more vulnerable to accumulated inertial pressures. It may be that firms cannot adapt to their environments in a series of small, incremental moves (Romanelli & Tushman, 1994). Both arguments can be evaluated with a test of the following:

> *Hypothesis 6: The longer a firm's experience in its niche under generational technological change, the weaker its performance.*

Characteristics of a Focal Niche

Hypotheses 1–6 suggest that, under conditions of technological change, a firm's performance depends on its conduct with regard to other firms. We predict that outcomes reflect the timing of a firm's technology adoptions, the way it is positioned with respect to local rivals, and whether its choices result in a niche shift or in further accumulation of experience. Additionally, performance may depend on the characteristics of a niche itself. Researchers following one strand of strategic management theory have always stressed the value of occupying attractive competitive positions. To what degree is strong performance the result of belonging to a favorable niche?

Ecological theory suggests that organizations in more densely populated environments are less successful. This may simply reflect the fact that many firms are dividing a finite set of resources. However, neoclassical economic theory also suggests that the more competitors a firm has, the more difficult it becomes to steer rivalry away from the perfect competition that theoretically drives all profits to zero. Additionally, Schoonhoven, Eisenhardt, and Lyman (1989) showed that waiting times preceding first product introduction dropped as the number of competitors rose. This finding suggests that the more firms there are in a niche, the shorter is the innovation cycle for each. The pressures may weaken a firm's performance.

> *Hypothesis 7: The greater the population density of its niche, the weaker a firm's performance.*

Munificence is a second characteristic that may make a niche more favorable. It generally means a high ratio of resources to the number of rivals competing for them (Dess & Beard, 1984). The more resources per competitor available in a niche, the more attractive it is, other things being equal. However, munificent environments are also attractive to new entrants, and entries may constrain a firm's ability to translate munificence into strong performance (Baumol, Panzar, & Willig, 1988). Consequently, we focused on growth in munificence. A high rate of growth creates slack, reduces the intensity of rivalry, and enhances performance. It is positive change in munificence over time that makes a niche structurally favorable and boosts the performance of its occupants.

> *Hypothesis 8: The greater the munificence growth in a firm's niche, the stronger the firm's performance.*

A third characteristic that may make a niche attractive is the extent to which it contains a stable set of rivals from period to period. Niche tenure (Hypothesis 6) reflects learning about niche conditions in general. We now focus on learning about other competitors in a niche (Lant & Baum, forthcoming). As local rivals become more familiar, managers grow increasingly able to accurately gauge the intentions of their competition and to make appropriate decisions in anticipation or in response. A firm's niche is structurally favorable when it contains a high proportion of familiar local rivals because the firm knows how to compete with them and how to signal them. One implication is that stable rivalry can benefit all firms in a niche. Another is that exits from a niche are not necessarily beneficial to firms that remain. If familiar local rivals depart and are replaced by unfamiliar new entrants, firms staying in the niche will be adversely affected.

> *Hypothesis 9: The greater the proportion of rivals in a firm's niche during period* t *that were also in its niche during period* $t - 1$*, the stronger a firm's performance.*

Characteristics of Other Niches

A niche may be attractive not only because of its own characteristics, but because it has favorable relationships with other niches. The evolution of relationships among niches is a large, complex topic that we intend to address in another work. Here, we set out two null hypotheses meant to distinguish local rivalry from diffuse competition in an overall market.

We argue in Hypothesis 4 that the greater a firm's average distance in resource space from others in the same niche, the stronger its performance. Our theory of local rivalry suggests that differentiation in resource space is important principally within a niche. Firms in other niches may exert effects that range from beneficial through neutral to competitive, and cross-niche pressures need not be symmetrical (Brittain & Wholey, 1988). Further, the relationships among firms in different niches may not be strictly competitive. They could be neutral, or even mutualistic. With respect to competitors outside the niche, what matters is the structural relationship among niches, not how distant the firm is from nonlocal rivals. However, population ecology and the preponderance of economic thought on market structure do not include effects from intraindustry structure. These familiar perspectives suggest an alternative hypothesis: performance depends on a firm's average distance from all rivals, not just local rivals.

> *Hypothesis 10: A firm's average distance in resource space from firms in other niches has no significant effect on its performance.*

In Hypothesis 7, we propose that firm performance is inversely related to the population density of its niche. With respect to an entire population, however, a firm's performance will rise or fall not with higher density in other niches, but with the relationship of its focal niche with other niches. Our position contrasts with theory and empirical evidence from organizational ecology. Both suggest that organizational mortality depends instead on the density of a population as a whole. We test our position that the only main effect of density on performance is felt among local rivals.

> *Hypothesis 11: The aggregate density of other niches has no significant effect on a firm's performance.*

METHODS

We developed a unique data set on the U.S. microcomputer industry that is used to test the hypotheses. The database is described next. We then explain the methods used to identify niches and test our hypotheses.

Data

Our analysis used computer industry, firm, model, and component information for the ten-year period 1982–91. The data were collected from a commercial market-analysis company; industry publications like *PCWeek, PC Magazine,* and *Byte Magazine;* archival sources including government publications; and primary sources, including representatives of Apple Computer, IBM, and Compaq and experts in computer science and electrical engineering.

Several advantages made the U.S. microcomputer market well suited for the study of innovation, complexity, and performance. Over the period that we investigated, there were three generational technological changes and three or more contemporaneous generations. There was also remarkable growth in the number of competitors, models, and shipments.

We drew on the Processor Installation Census (PIC) file produced by the International Data Corporation (IDC) for annual data for every model of microcomputer sold in the United States, including the number of units sold and the average selling price. IDC is the oldest of the many firms that track the American computer industry and is highly respected. It began the Processor Installation Census in 1964 and has built up a network of thousands of sources, including manufacturers, distributors, and end users. The information permits it to assemble the most accurate picture available of computer sales. We added type of microprocessor and other information from additional sources.

The study population includes all firms that manufactured a microcomputer for sale in the United States from 1982 through 1991. There was rapid expansion throughout the period. In 1982, the Processor Installation Census recorded that 86 firms shipped 1,272,000 units; in 1991, 553 firms shipped 7,477,000 units. In the sampling period, the number of models in the market increased from 142 to more than 1,700. New entrants accounted for more than 30 percent of the population in some years. We have noted that it was a time of important technical advances. The Intel 80286 was the newest microprocessor in the market in 1982. The 80386 microprocessor was introduced in 1985. Another generation, the 80486, was introduced in 1989. There were no perfect substitutions, however, and many personal computers using different microprocessor generations have been in the market contemporaneously. For example, just as the 80486 was announced, a new version of the 80386 began shipping. As reported by IDC, portables were first shipped in 1981. Although the volume for this early activity was very small, portables were in the market throughout the time period of the study.

All the hypothesis tests required that we identify niches and evaluate them over time. We used a special type of cluster analysis for the job. We first summarize our niche clustering technique. We then describe the independent variable for each of the hypothesis tests. Descriptions and formulas for the measures are presented. The derivation of the dependent variable, which we believe is new to the organization management literature, is described. Finally, we explain our pooled time series analysis of cross-sectional data and report the results of our hypothesis tests.

Niche Cluster Analysis

Identifying niches. We had to take a preliminary step before testing the hypotheses: empirical identification of the niches in which firms locate under generational technological change. In social science research (McPherson, 1983; Salop, 1979), relations among organizations are commonly modeled by their distance in *n*-dimensional space. In organizational and strategic studies, dimensions are usually forces affecting firms' performance, and distance is a proxy for similarity. Like firms are colocated in market space, and their similarity is measured with cluster analysis (Cool & Dierickx, 1993).

Although strategy scholars traditionally use clustering to find industry substructures like strategic groups, critics have cited significant weaknesses in the familiar methods (Barney & Hoskisson, 1990). First, the choice of how many clusters to extract is usually somewhat arbitrary, so it is difficult to replicate. Second, most clustering methods, particularly those that start with "seed" points, may create groupings that are not globally optimal. This occurs because the clustering algorithm calls off its search too soon. Again, this can make it difficult to replicate solutions and to predict performance (Ketchen, Thomas, & Snow, 1993). Finally, many clustering methods produce classifications that are not necessarily stable over time. The solution in one year may be only weakly related to that in the next. Consequently, firms might appear to be switching clusters all the time, when instead the cluster solutions simply are not consistent across years. To make improvements, some researchers interested in intraindustry dynamics have applied familiar methods in new ways. For example, in a study of group dynamics among offshore oil-drilling companies, Mascarenhas (1989) used two-stage cluster analysis and evaluated the structure with reference to changing economic conditions. Tang, Thomas, and Fiegenbaum (1994) used a Markov-chain model to describe movement among strategic groups. However, a class of entirely new methods improves on imaginative approaches like these in terms of the likelihood of an optimal solution and elegance.

To address the three shortcomings of familiar techniques, we employed Tabu Search, an innovative model that is well established in the operations research literature but has not been employed in organizational research. It is a memory-heuristic method, akin to a neural network, that produces a cluster solution with many superior properties (Glover, 1989, 1990). It objectively and globally optimizes a quality measure determined by the researcher using it. Tabu Search not only finds superior clusters over time, but also objectively defines the optimal number of clusters in each year. Consequently, it avoids the replication problems common to other methods. Given the same quality measure and search-termination rule, other researchers with the same data will arrive at the same clusters. The clusters are more likely to be globally optimal for each year and maximally consistent across years. In effect, we used cluster analysis to construct the niches, and we substituted Tabu Search for familiar clustering techniques. More detail on the niche cluster method can be found in Appendix A.

Measures for the niche cluster analysis. For our purposes, a niche is defined as a cluster of firms in the personal computer market with relatively similar product line specializations and relative price points for their products across technology generations and similarity as to whether or not they sell portables. Appendix A gives the formula for each of the variables used in the cluster analysis.

Each niche is partly defined in terms of technology generations that correspond broadly to 8088, 80286, 80386, and 80486 microprocessors. Table 1 provides more detail and a complete list of microprocessors in each technology generation.

Each firm is characterized by the degree to which it specialized or generalized with regard to technology. First, we considered the contribution to sales volume of each technology generation. For each, we measured *technology generation volume,* a firm's unit sales in a given generation compared with its total sales.

Second, *technology generation breadth* is the scope of a firm's market presence in each generation as measured by the number of models, compared with the maximum number of models offered by any firm in the same generation and year. Where volume tells the relative market response to each firm's product line, technology generation breadth indicates the locus of product development, marketing, and distribution.

Third, we included *pricing,* the degree to which a firm stakes out a low- or a premium-price position and varies the choice across its product line. We measured the average price of the models a firm sold in each generation. We then divided by the maximum average price any firm charged for models of that generation in the year. The result is a comparison of price position across firms.

Fourth, to tap innovative (versus following) conduct with regard to new technology, we included the dummy variable *latest generation.* It takes a positive value if a firm offered the latest microprocessor available in its products in a given year.

Fifth and finally, we distinguished each firm's product line by *portable*

TABLE 1
Microprocessors by Technology Generation, 1982–91[a]

	Technology Generation			
Maker	**1**	**2**	**3**	**4**
Intel	8085, 8086	80286	80386	80486
Zilog	8088, 8088A	V20	80386SX	80486SX
	8800, 80186		80386SL	80486DX2
	Z80		V30	V40

[a] Having studied a variety of the characteristics of PCs, we concluded that the most parsimonious way to describe technology generations among PCs was through their microprocessors. Each generation is a configuration of technical characteristics (e.g., internal bus, clock-speed, MIPS, number of transistors) that also typically coincides with a particular group of computer models (e.g., Intel 8088 and the IBM PC), indicating marketing as well as technical differences among categories. We consulted electronic engineering sources (Liu, 1991; Liu & Gibson, 1984; Morse, Isaacson, & Albert, 1987), vendors (Apple, IBM), and academic and industry experts to identify and group similar microprocessors. Our data showed more than 30 different microprocessors in some years. Many had small unit shipments and, treated individually, they reduced degrees of freedom while adding little information. We excluded them to conform to limits on the input data matrix.

presence, the portion of its total shipments that consisted of portable computers. Although these machines use microprocessors that are typically the same as for desktops, they meet a customer need for mobility that desktops do not address.

We chose to focus on microprocessors, instead of examining all of the technical characteristics of a microcomputer, for two reasons. First, we were most interested in generational technological change. Generational change is innovation in microcomputers themselves and is not the same as an advance in peripherals (e.g., improvement in graphics standards or increase in fixed disk drive capacities). In this market, each technology generation is widely marked by each new, fundamentally more capable microprocessor. Second, from its inception, the DOS/Intel architecture has been open. Computer retailers have typically allowed customers to choose from a menu of options (often via add-in circuit cards) dictating the graphics quality, size of fixed disk drive, amount of random-access memory, number of input/output ports, and so forth, that would be sold with a given computer. Thus, it is not possible to establish with confidence what peripherals were sold with any particular machine. The only characteristic of a PC that was completely under the manufacturers' control during the period of this study was the microprocessor.

Duration of niche clusters. We treated years as independent trials and allowed evidence of change or stability to emerge from the data, employing Tabu Search to produce the most consistent clustering possible over time. We applied simple, replicable decision rules to determine whether clusters continued year-to-year. (See Appendix A, especially the section entitled "Identifying Continuing Niche Clusters," for details.) The optimum solution produced 15 distinct clusters over the ten years that we observed. Table 2 shows the duration of each niche cluster.

Niche clusters and market dynamics. We now illustrate our niche clusters against the background of the PC industry during the period 1982–91. Unlike previous studies of market subpopulations, this study did not focus on the taxonomy of firms' positions represented by the niche clusters. Neither do we interpret each one in each year. Instead, this section describes the niche clusters and year-to-year transitions found at the start of the sampling period (1982 and 1983) and at the very end (1990 and 1991). We offer these observations and exemplars to help explain our statistical analysis and findings.

At the end of 1980, the personal computer market was about five years old and consisted of dozens of companies offering mostly incompatible machines. CP/M had been the dominant operating system; however, there were many variations. Each company also had a unique design for its floppy disks. Users typically could not run the same programs on different brands, so they were locked into a single computing environment. The market scope of most individual models was small by today's norms—even if they were popular, like Commodore's entry-level PET computer. The fragmented market was ripe for standardization. In the third quarter of 1981, IBM introduced its PC.

TABLE 2
Niche Cluster Appearance, Duration, and Exit[a]

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1982	•	•	•												
1983	•	•	•												
1984		•	•	•											
1985		•	•		•										
1986		•	•		•	•									
1987		•	•			•	•	•							
1988		•	•			•		•	•	•					
1989		•				•		•	•		•	•			
1990		•						•	•		•		•	•	
1991								•	•		•		•		•

[a] We opened a new column the first time we identified a new cluster and recorded a "•" in that year. A "•" is then recorded in each year each cluster appeared. A total of 15 different clusters were identified over the ten years of the sampling period.

The famous name meant instant legitimacy, which was reinforced by a library of applications software that was ready before the first computer was shipped. Sales were also boosted by the Lotus 1-2-3 spreadsheet. The first "killer app" for the IBM-PC, it was a software package whose popularity actually increased demand for the computer. It helped cement the standard of Intel microprocessors and Microsoft's PC-DOS for ten years.

Our data are consistent with this image of a growing, yet structurally consistent, market in 1982 and 1983. We identified three niche clusters, one occupied by broad generalists and two by different kinds of specialists. (Niche cluster numbers refer to those in Table 2.) Companies in niche 1 in 1982, among them Hewlett Packard and Olivetti, were the only ones to offer portable computers. These firms were generalists since they also tended to offer desktop computers with 8088 vintage microprocessors. Firms in cluster 2, like Xerox, specialized in 80286 desktops, which was then the latest technology generation. Companies in cluster 3, including Acer Altos and Commodore, specialized in 8088 vintage technology and had no offerings in other desktop categories or in portables. Despite an accelerating market with a high entry rate, no new niches appeared through 1983. A kind of dynamic stability obtained in the market, which seems a likely influence of the IBM-PC standard. However, 1983 was the last year without at least one birth or death of a niche. For example, in 1984 niche 1 exited. Niche 4 appeared, distinguished by generalist firms that offered the newest desktop models at premium prices. In every succeeding year through 1991, the data show some change in the niche clusters in the PC market.

As new generations entered, patterns of specialization and generalization changed. In 1990, near the end of the sampling period, all six niches that we identified contained generalists of some type. They were distinguished from each other by emphasis, as measured by shipments and models, on older or newer technology generations. In the same year, U.S. sales grew at about 13 percent, down from over 30 percent annually in the 1980s. Some industry analysts announced that the PC market was near saturation. Intense price competition among AST Research, Dell, IBM, and Compaq in older generations reinforced that claim. In contrast, new technology, including PCs driven by the relatively new 80486 microprocessor, commanded a premium.

Four niche clusters continued through the transition between 1990 and 1991. Additionally, niche 15 appeared for the first time, and niche 2 exited. We finally identified five niche clusters in 1991. There was little evidence of specialization in any particular technology generation, as there was ten years prior. Instead, niches were distinguished by different kinds of generalist market positions. As in 1990, differentiation was based on technology generations across product lines and corresponding differences in price. Firms in each niche offered portables, and most sold desktops of several generations. As measured by their shipments and the number of models in different technology generations, however, emphasis on innovation varied across niches. Consistent with slower growth, exits were frequent in 1991. Still, the PC market continued to attract entrants. Consider niche 11, which first appeared in 1989. Ten companies formed a consistent core group through 1990 and 1991. Among them were Altima Systems, Dolch, and Intra Electronics. Twelve companies exited, including small players like Bi-Link and Psion. Yet there were 22 entrants.

With these illustrations of niche clusters and market conditions as anecdotal background, we next describe the variables used in the analysis and our methods.

Dependent Variable

The dependent variable is the difference between a firm's predicted market share in each year and its realized market share. This residual may be positive or negative. The bigger the difference, the greater the share that cannot be explained through relative pricing alone. The measure is particularly well suited to these data and empirical tests. First, it calculates relative performance in competition. Rumelt (1984) argued that firms succeed by their ability to realize performance better than the norm in their market. Second, it calculates advantage in a highly standardized market. Firms with greater share perform better where buyers incur switching costs, products are standardized, and installed base is positively related to links with buyers and suppliers (Gabel, 1987). Additionally, the great majority of firms that competed in the U.S. microcomputer market between 1982 and 1991 were privately held. Neither market nor accounting measures of performance are available. An added complication is that many firms producing PCs also made other types of computers, and it would be difficult to assign accounting profits to their microcomputer lines of business alone. Market share is well reported in our data and does not have the noise in some other measures.

We were less interested in a firm's market share per se than in its ability to command a market share in excess of what one would expect, given the price of its computers. This difference would amount to a premium that cannot be explained simply on the basis of price (Carpenter & Nakamoto, 1990; Urban et al., 1986). To measure this premium, we turned to the marketing research literature. The attraction model originated as a market share forecasting tool. In situations in which consumers choose one brand over a set of alternatives, market share is determined by their attraction to each brand. The predicted share of a brand depends on the relationship between its price and the price of all other alternatives. The derivation, presented in Appendix B, is developed fully in Cooper and Nakanishi (1988). In a thorough review of market share analysis, Ghosh, Neslin, and Shoemaker (1984) concluded that the attraction model is as efficient an estimator as other common models.

It has the desirable property of producing market share estimates bounded by 0 and 1 that sum to 1. With some data sets, regression techniques can produce market share estimates outside these bounds. It is also well suited to time series data, such as ours, that have unequal numbers of observations per firm (owing to firms different entry and exit times). The constant term B_{kt} incorporates the market attraction of all the computers available in a given time period. Those that do not exist in year t do not contribute to B_{kt}.

For each year, we used each firm's price vector to estimate its market share in each technology generation. Brand dummies were included for ten firms that consistently had high market shares over the ten years studied, to allow for the possibility of different intrinsic preferences for these brands.

Independent Variables

Measures were designed so that the proposed main effect could be tested with one independent variable. In the following section, a capsulated description of each is listed alongside the associated hypothesis. Descriptions and formulas for all variables are in Appendix B. In the baseline model, *firm age, industry demand,* and *industry growth* were introduced as time-varying control variables. Organizational ecologists and other evolutionary theorists often relate performance and survival to an organization's age. We included industry demand in the baseline model to measure marketwide slack and scarcity. The U.S. microcomputer industry grew very quickly throughout our sampling period, so we included demand growth to control for the changing market in tests for effects like the change in munificence within niches.

To calculate *technology adoption lag* for Hypothesis 1, we simply began a counter at 0 the year any firm introduced a new microprocessor. The counter was increased by 1 for every year that a firm produced microcomputers but offered none of the latest generation. This counter was reset to 0 each time a new generation of microprocessors appeared.[1]

For Hypothesis 2, we calculated a firm's *higher innovativeness* as the portion of other firms in its niche whose most advanced computer was at least one generation older that the focal firm's. For Hypothesis 3, *lower innovativeness* was the portion of other firms in its niche that offered a model from a newer generation.

We proposed that the greater the average distance between each firm and others in its niche, the stronger its performance. We used simple euclidean distance, summing the difference between a firm's vector in the ten-dimensional market space used in clustering and that of each other firm. For the test of Hypothesis 4, *differentiation within a niche* was defined as the Z-score of distance from each firm to the others in its niche.

Hypothesis 5 predicts that firms that change niches exhibit weaker performance. *Niche change* was represented by a dichotomous dummy variable. Any firm that was not in the same niche cluster in year $t - 1$ and year t was considered to have switched niches in year t. This could happen either because the niche continued but the firm moved to another one, or because the niche in year t did not continue into year $t + 1$. Each firm is assigned the value 0 (no switching) in its first year of shipping.

For Hypothesis 6, we measured *niche tenure* by increasing a counter by 1 for each year since a firm's market entry or last niche change.

Niche density, used in the test of Hypothesis 7, was a simple count of the number of other firms in each firm's niche.

Next, we characterized *munificence growth* for the test of Hypothesis 8. For each niche in each year, we computed the ratio between demand among all firms in the niche and the number of firms occupying the niche (demand per firm within the niche). We then divided this result by the same number for the previous year, substituting a missing value for the first year in the study. This calculation measured the year-to-year growth in per-firm demand within a niche.

We examined the portion of *stable rivals* in each niche for Hypothesis 9, dividing the number of firms that had been in a niche in both year t and year $t - 1$ by the number of firms in the same niche in year t. (This measure has a value of 0 the first year a niche appeared.)

For Hypothesis 10, *differentiation across niches* was the Z-score of all distances among each firm and all others outside its niche.

Density of other niches in Hypothesis 11 was the number of firms in the market outside a given firm's niche. This is a measure of marketwide competition, and it complements niche density, the independent variable for Hypothesis 7.

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[1] We thank an anonymous reviewer for pointing out the possibility of reverse causality in the case of Hypotheses 9 and 12. We argued that firms with poorer performance are more likely to switch niches and to lag behind others in adopting new technology. To investigate these possibilities, we regressed niche change against firm performance in year $t - 1$. We also tested technology adoption lag against firm performance in year $t - 1$. In neither test was the relationship significant.

RESULTS

We used ordinary-least-squares regression analysis to test the pooled time series of cross-sectional variables. Table 3 shows the frequencies, means, and standard deviations for variables used in the tests of Hypotheses 1 through 11 as well as a correlation matrix for all variables. We found no correlations that would raise a concern for collinearity. Still, it sometimes appears in longitudinal data. We therefore computed variance inflation factors and confirmed that there were no signs of collinearity. In an additional check, a factor analysis indicated the relation among the independent variables was insufficient to estimate a factor structure. Autocorrelation is also a common concern in data like ours. We examined the residuals in relation to time and the independent variables and found no discernible patterns.

Table 4 displays results for the fully saturated regression model. It contains the baseline with three control variables and the conduct and structure variables.

The first group of tests focused on local rivalry and maneuvering in accelerated markets. Hypothesis 1 emphasizes technology adoption lag. We propose a negative relationship that associates stronger performance with earlier adoption. Consistent with our expectation, the test result was significant, and the hypothesis is supported.

Hypotheses 2 and 3 suggest that a firm's performance is affected by its position on new technology relative to others in its niche. Those ahead on innovation will perform better, those behind will have weaker performance. The test for Hypothesis 2, regarding higher innovativeness, returned a significant result with the expected sign. Hypothesis 2 is supported. The finding for Hypothesis 3, where the independent variable is lower innovativeness, is not significant.

According to our model of local rivalry, a firm faces the most intense competition from other firms in its niche. Our finding with regard to Hypothesis 4 is significant and has the expected sign. It lends support to our notion that the surest route to strong performance is by differentiation within a niche from immediate rivals.

Hypothesis 5 predicts that firms that change niches incur a penalty—a relative performance decline in the year following a move. The test result is significant, and the sign is as expected. It supports the prospect of weaker performance in the short term among firms that change niches.

We predicted a negative relationship between niche tenure and performance in Hypothesis 6. The result is significant and has the expected sign. In the accelerated market for personal computers, experience does not implicitly lead to competitive advantage.

The next group of tests focuses on the structure of the niche in which a given firm actually competes. We tested for the impact of the number of

TABLE 3
Descriptive Sample Statistics and Correlations

Variable	*n*	Mean	s.d.	1	2	3	4
1. Performance							
2. Firm age	2,075	0.21	0.27	.26***			
3. Industry growth	2,075	0.21	0.27	.06**	−.09***		
4. Industry demand[a]	2,132	13,917,212	4,904,283	−.09***	.16***	.64***	
5. Differentiation in niche	2,132	0.00	0.99	.13***	.11***	.00	.00
6. Differentiation across niches	2,132	0.00	0.99	−.00	−.04*	.00	.00
7. Niche change	2,132	0.39	0.48	.02	.26***	−.26***	.40***
8. Niche tenure	2,132	1.63	1.05	−.00	.19***	.05*	−.07***
9. Lower innovativeness	2,132	0.02	0.07	−.03	−.03	.07***	.02
10. Higher innovativeness	2,132	0.77	0.38	.01	−.07**	.14***	−.36***
11. Technology adoption lag	2,132	1.59	1.18	−.06**	−.04	.20***	−.02
12. Niche density	2,132	73.75	34.78	−.00	.02	.11***	−.08***
13. Niche density squared	2,132	6,649.03	5,549.30	−.00	.02	.11***	−.04
14. Density of other niches	2,132	165.17	72.58	−.07***	.07***	−.62***	.78***
15. Munificence growth	1,599	1.97	2.15	.02	.01	.07	.08***
16. Stable rivals	2,132	0.35	0.25	−.04	−.08***	.30***	−.25***

* $p < .05$
** $p < .01$
*** $p < .001$
[a] Deflated dollar sales are shown.

firms in a niche in Hypothesis 7. Niche density does not have a significant effect on performance. We made the same test using density squared, the preferred measure in population ecology studies. The result was not significant.

Hypothesis 8, stating that munificence growth in a niche enhances performance, was not confirmed. The result is not significant, even though the sign is positive, as predicted.

Given the increased certainty that comes from experience with the competition, Hypothesis 9 predicts that firms facing stable rivals perform better than those facing unfamiliar rivals. The test result is not significant.

We took up marketwide maneuvering and competitive intensity in the final two tests. In our view, findings that differentiation and innovativeness matter in firms' performance in local rivalry are more interesting if they contrast with competition in the overall market. We distinguished differentiation within a niche (Hypothesis 4) from differentiation across niches. The latter independent variable is tested in Hypothesis 10. As expected, the result is not significant. We conclude that distance from firms outside of a given firm's focal niche is not related to its performance. The effect of numbers of competitors in the overall market but outside the firm's niche (i.e., the density of other niches) is tested in Hypothesis 11. The relation is not significant, as our model predicts.

DISCUSSION

We originally argued that two types of factors might influence the fate of firms facing generational technological change: their own maneuvering and

TABLE 3
(continued)

5	6	7	8	9	10	11	12	13	14	15
.14***										
.14***	−.11***									
−.07*	−.06***	−.48***								
−.04*	.01	−.09***	.09***							
−.06**	−.15***	−.27***	.19***	−.01						
−.13***	.04*	−.14***	.13***	.39***	.62***					
.13***	−.50***	−.11***	.19***	.08***	−.09***	.00				
.12	−.41***	−.06***	.14***	.06***	−.20***	−.03	.97***			
−.06**	.24***	.02***	.08***	.09***	−.18***	−.04*	−.57***	−.56***		
.02	.03	.09	−.04	.62	−.27	.00	.11***	.12***	.10	
−.11***	−.18***	−.50	.46	.08	.39	.20	.32***	.24***	−.25***	−.20***

the attractiveness of their niches. Our local rivalry model also led us to predict that we would observe no effects from a third factor, the aggregate demography of nonlocal rivals. Our results suggest that in innovation-intensive environments, maneuvering against local rivals is more important than picking the right niche.

Positioning under conditions of generational technological change is a delicate balancing act. One factor is an inexorable clock that keeps ticking while a firm delays adopting a new generation of technology. The sooner a

TABLE 4
Results of Pooled Time Series of Cross-Sectional Measures

Variable	β
Constant	1.39
Firm age	0.28***
Industry growth	0.09*
Industry demand	−0.05
Technology adoption lag	−0.11*
Higher innovativeness	0.13*
Lower innovativeness	0.01
Differentiation within a niche	0.11***
Niche change	−0.09**
Niche tenure	−0.18**
Niche density	0.09
Niche density squared	0.33
Munificence growth	0.03
Stable rivals	0.01
Differentiation across niches	−0.06
Density of other niches	0.05
F	11.74***

* $p < .05$
** $p < .01$
*** $p < .001$

firm innovates, the better it performs, other things being equal. Further, the firm's position relative to its local rivals influences this innovation imperative. Its performance is stronger the larger the proportion of local rivals that are at least a generation behind. We did not find a significant disadvantage from lagging a generation. This result does not align perfectly with the other findings on innovativeness. We attribute it to the potential for a firm to occupy a viable position in older technology in the short term by, for instance, competing on price in a niche characterized by an earlier technology generation.

Another factor complicates a firm's attempts to position itself favorably. If the combination of its product line choices and those of rivals cause it to switch niches (either through action or inaction), it pays a temporary penalty. Therefore, the rule "adopt new generations of technology as soon as you can" is too simple. The moving penalty might exceed the cost of lagging, especially if only a small proportion of local rivals have adopted. A company's management might then conclude that the rule is "adopt new generations of technology as soon as you can, as long as you don't switch niches." However, there are two problems with such a rule. First, it is only clear ex post whether a firm's choices cause it to stay in the same niche. The outcome of its choices depends on what other firms do, which cannot be known with certainty in advance. Second, a firm pays a penalty as its tenure in the same niche grows longer. It must trade off the cost of switching niches in any given period against the damage of staying in the same niche while the market evolves. The third influence on a firm's performance is its ability to offer a product line that differs in price or technology from those of its local rivals. There are limits, however, on how far a firm can go to differentiate itself because of the moving penalty.

All these factors are more important than finding a thinly populated niche, or one in which munificence is growing, or one that contains familiar, well-understood rivals. It may be that in accelerated markets, the attractiveness of a niche changes too quickly for firms to be able to identify, occupy, and defend favorable positions. It seems clear, however, that managers must understand the niche they occupy, given their price-technology positions and those of others. Competition is not a war of all against all. A firm needs to occupy a distinctive position with respect to local rivals, but not with respect to all other firms marketwide. Increasing market density as a whole doesn't seem to generate competitive pressure. Rather, we suspect, density exerts influence through the ways that niches are structurally related to one another.

Our study has several inherent limitations but should still open the door for a number of new lines of inquiry. The analysis is based on a ten-year span in one technology regime within one U.S. industry. Unlike many studies, however, this one includes an entire population of firms. During the sampling period, both demand and the number of competing firms grew dramatically. Applying the results to industries that experience a wider range of conditions may be inappropriate. Microcomputer industry experience may not generalize well to other settings, such as service sectors, in which process innovation is paramount. We focus principally on microprocessor technology and acknowledge that other changes in computing (e.g., new generations of software applications like MS Word, or operating-system software such as Windows) may also have an impact. We attribute market complexity to generational technological change. Other possible sources are not explored here. Additionally, our observations concerning niches and local rivalry may not hold in markets in which technological change is less of a factor. Although we contend that the ability to capture market share beyond a benchmark expected share is an interesting dependent variable, future studies might also include other performance measures. Finally, we are aware that there may be hazards in generalizing to other countries and cultures based strictly on a sample from the United States. Most of these limitations are due to our decision to conduct a longitudinal study of an entire population. Replication of our design would be useful. It might be at least as useful for future researchers to adopt a different design; for example, rather than using full population coverage and a ten-year time series, they might more fully cover a particular construct, like the effects of standards or complementary products.

Several avenues of future research seem very promising to us. One is methodological. Our empirical analysis features two methods that we believe are new to organizational management research. One is the attraction model used to calculate estimated market share, an input to the dependent variable. Conceptually, use of this model looks appropriate where benchmarked performance is preferred to an absolute measure. The other is Tabu Search, which we used to cluster the firms over time. This memory heuristic search method is rather different from the clustering methods that organization researchers have used for years. It has the advantages that it is more likely than other methods to generate an optimal solution and produces replicable clusters without subjective interpretation. Future empirical research may turn up additional lessons on its use.

A second avenue that bears exploration is the relationship between a firm's strategic choices, such as scope and resource deployment, and its niche position. In our view, strategic group research has been hindered by its insistence on grouping firms that make similar strategic choices in order to study why some groups enjoy higher profits. This assumption leads to inferences based on the supposed influence of unobservable coordination mechanisms such as collusion. It limits the theory's ability to handle truly dynamic environments. We suggest that future studies explore the extent to which firms occupying the same niche can differentiate themselves from local rivals by making distinctive strategic choices (e.g., resource allocations) that others find difficult to imitate. We suspect that some niche members persistently enjoy higher performances because they approach local rivalry in unique ways, perhaps with distinct capabilities.

A third area for future research is the study of niche evolution and cross-niche structural relationships. We need to understand more about how and why niches appear, transform, and disappear. We should also explore why some niches have competitive relationships but others have symbiotic or mutualistic ones. It might also be interesting to study the effect of organizational ties (e.g., strategic alliances) among members of niches with different patterns of coefficients in a competition matrix.

The study of accelerated, innovation-intensive markets is in its infancy; so is the study of niche formation and its impact on the members of organizational populations. Generational technological change links the two, helping researchers understand how innovation within an apparent era of incremental change systematically creates complexity that affects rivalry and firm-level outcomes. We can increase the power of punctuated equilibrium models by supplementing them with insights into patterns of technology evolution whose periods are much shorter. Doing so will prove increasingly necessary as scholars and managers strive to make sense of changes so rapid that they seem to be continuous.

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APPENDIX A

Niche Cluster Method: Tabu Search

Methods

The cluster solution used to identify market niches is derived with Tabu Search, a well-developed method widely accepted in mathematical modeling (Glover, 1989, 1990). Familiar clustering methods are like a random draw on a set of solutions. They may produce a global optimum in one draw, but it is unlikely. Tabu is instead a systematic search through a large number of solutions that discards second-best local optima as it proceeds. A globally optimal solution is much more likely.

Tabu Search is one of a class of relatively new algorithms that, like neural networks, mimic the human brain's information processing. It is a heuristic procedure based on a meta-strategy that uses complex memory structures to locate high-quality solutions to combinatorially difficult problems. It "remembers" and "forgets" results as necessary to improve the solution as the search continues. It applies a decision rule specified by an analyst over an unusually large number of iterations and, at each iteration, makes a very large number of comparisons among data points. In this way, the likelihood of finding a global optimum increases dramatically. Additionally, Tabu Search can continue beyond local optima by forcing the search into new, unexplored solutions. This process often leads to further improvements.

This clustering problem is combinatorially difficult and can be shown to be in the class NP-Hard (Gary & Johnson, 1979). This means that it is highly unlikely that an algorithm could be designed to find absolute optimal solutions in a reasonable amount of time. To overcome this obstacle, we used Tabu Search to determine a high-quality solution. The interested reader should consult Glover's articles for additional detail.

The purpose of the method is to produce superior clusters and objectively define the optimal number of clusters. There are two phases to the analysis. In the first, the optimal number of clusters is determined. The second phase produces a high-quality solution using the optimal number of clusters.

Determining the number of niche clusters. We first defined a measure of cluster quality to guide the combinatorial search. Consider a set of points in R_n denoted P. Let d_{ij} be the euclidian distance between point i and point j. Let μ and σ denote the mean and standard deviation, respectively, for all distances. A clustering of P partitions the points into m disjoint sets denoted by $C = (c_1, c_2, c_3, \ldots c_m)$.

For a given clustering, d_{ij} is called the *internal distance* if i and j are in the same cluster. The goal is to determine a solution with the minimum number of clusters that does not include any internal distances greater than $\mu + 1.28\ \sigma$ (for a normal distribution, $Z = 1.28$ corresponds to excluding 10 percent of the distances). This rule allows for reasonably compact clusters with relatively little constraint on the search itself. A secondary goal is to minimize the average of all internal distances.

Identifying the niche clusters. Each year from 1982 through 1991 was treated as an independent clustering problem. Initially, firms were randomly assigned to clusters for an unbiased starting point within each year. Next, effects of transferring each firm to another cluster were evaluated. The transfer that improved the quality measure most was performed and the selection procedure repeated. Eventually, all possible transfers resulted in nonimproving moves. At this point, the Tabu Search algorithm continues. Using memory structures that allow nonimproving transfers, the algorithm is able to escape local optima and potentially, to find better solutions.

Identifying continuing niche clusters. In order to decide whether a cluster in year *t* is the same as a cluster in year *t* + 1, we used two simple, easily replicable rules. First, if 50 percent or more of the members of a cluster in year *t* were also grouped together in year *t* – 1, we concluded that the cluster persisted from one year to the next. If 50 percent or more of a t – 1 cluster's members were not placed together in year *t*, we examined the different clusters to which the members belonged in year *t*. If exactly one of these year *t* clusters derived a majority of its members from the *t* – 1 cluster, we concluded that the cluster had persisted from one year to the next, losing more than half of its membership but maintaining a recognizable identity. If neither of these conditions were fulfilled, we concluded that the year *t* – 1 cluster did not continue into year *t*. All year *t* clusters that could not be mapped onto year *t* – 1 clusters were designated as new, with a history commencing in year *t*. See Table 2 for a diagram of niche cluster duration over the sampling period.

Measures

$$\text{Technology generation volume}_{it}{}^{a} = \frac{\text{Shipments of firm}_i \text{ in year}_t \text{ of each technology generation}}{\text{Total shipments of firm}_{it}}$$

$$\text{Technology generation breadth}_{it}{}^{a} = \frac{\text{Number of models of firm}_i \text{ in year}_t \text{ of each technology generation}}{\text{Max}_j\,(\text{models of firms}_j \text{ in year}_t \text{ in each technology generation})}$$

$$\text{Pricing}_{it}{}^{a} = \frac{\text{Average price of models of firm}_i \text{ in year}_t \text{ in each technology generation}}{\text{Max}_j\,(\text{average price of firms}_j \text{ in year}_t \text{ in each technology generation})}$$

$$\text{Latest generation dummy}_{it} = 1 \text{ if firm}_i \text{ offered a model using latest technology generation available in year}_t$$

$$\text{Portable presence}_{it} = \frac{\text{Shipments of firm}_i \text{ in year}_t \text{ of portables}}{\text{Total shipments of firm}_{it}}$$

[a] Four variables, one for each desktop technology generation (see Table 1).

APPENDIX B

Dependent Variable and Measures for Regression Analysis

Realized-Expected Market Share[a]

We defined the dependent variable for the hypothesis tests as the difference between each firm's realized market share and its expected share derived from an attraction model. The dependent variable is expressed by

$$\Delta\, share_{ikt} = \frac{[\text{realized deflated dollar sales}_{ikt} - \mathrm{E}(\text{deflated dollar sales}_{ikt})]}{\Sigma\ \text{deflated dollar sales}_{jkt}}, \tag{1}$$

for each personal computer model from firm *i* in generation *k* in year *t*.[b]

$$\textit{Realized deflated dollar sales}_{ikt} = \Sigma(\textit{unit shipments}_{ikt} \times \textit{average price of units}_{ikt}), \times \textit{GDP deflator} \quad (2)$$

where, for firm *i* in period *t*

$$\textit{share}_{ikt} = \textit{deflated dollar sales}_{ikt} / \Sigma \textit{ deflated dollar sales}_{jkt} \; (j \text{ not equal to } i). \quad (3)$$

The attraction model (Cooper & Nakanishi, 1988) is

$$\textit{share}_{ikt} = \exp(B_{0ik})P_{ikt}B_{1k}/\Sigma_j \exp(B_{0jk})P_{jkt}\,B_{1k}, \quad (4)$$

where

B_{0ik} = the intercept,

B_{1k} = a strategy variable influencing attraction,

and

P_{ikt} = price.

Since the denominator is the same for every entry, it can be replaced by a constant, K_t. We then took the logarithm of both sides. Each brand has a unique intercept B_{0ik}. Since $\ln K_t$ is a constant, we used a dummy for each time period *t*.

$$\ln \textit{share}_{ikt} = B_{0ik} + (B_{1k} \times \ln P_{ikt}) - \ln K_t, \quad (5)$$

where

$$K_t = \Sigma_j \exp(B_{0jk})P_{jkt}B_{1k}.$$

The measurement model uses an OLS regression of the form

$$\begin{aligned}\ln \textit{share}_{ikt} = {} & b_0 + b_1 \ln \textit{price} + b_2 \textit{ brand dummy} + b_3 \textit{ category dummy} \\ & + b_4 (\textit{category dummy} \times \textit{price}) + b_5 \textit{ time dummy.}^{c}\end{aligned} \quad (6)$$

Measures for the Regression Analysis

$$\textit{Firm age}_{it} = (\textit{year}_t - \textit{year of firm}_i\textit{'s first shipment})$$

$$\textit{Industry growth}_t = \begin{matrix}(\textit{dollar sales of all firms in year}_t - \\ \textit{dollar sales of all firms in year}_{t-1})\end{matrix} \times \textit{GDP deflator}_t^{d}$$

$$\textit{Industry demand}_t = \sum_i (\textit{firm sales}_{it}) \times \textit{GCP deflator}_t$$

$$\textit{Technology adoption lag}_{it} = \begin{matrix}0 \textit{ in first year of a new generation;} \\ \textit{increment each year firm}_i \textit{ does not adopt}\end{matrix}$$

$$\textit{Higher innovativeness}_{it} = \frac{\begin{matrix}\textit{Portion of firms in the niche in year}_t \textit{ that have adopted} \\ \textit{the newest generation that firm}_i \textit{ has adopted}\end{matrix}}{\textit{Total firms in firm}_i\textit{'s niche in year}_t}$$

$$\textit{Lower innovativeness}_{it} = \begin{matrix}0 \textit{ if firm}_i \textit{ has adopted newest technology generation;} \\ \textit{if not, equals the portion of firms in firm}_i\textit{'s} \\ \textit{niche in year}_t \textit{ that have adopted the newest} \\ \textit{technology generation / total firms in} \\ \textit{firms}_i\textit{'s niche in year}_t\end{matrix}$$

$$\begin{matrix}\textit{Differentiation within} \\ \textit{a niche}_{it}^{e}\end{matrix} = \begin{matrix}\textit{Z-score of squared euclidean distance based on cluster} \\ \textit{variables (z is calculated using population } \mu \textit{ and } \sigma)\end{matrix}$$

$$\textit{Niche change}_{it} = 1 \textit{ if firm}_i\textit{'s niche in year}_t \textit{ does not equal its niche in year}_{t-1}$$

$$\textit{Niche tenure}_{it} = \begin{matrix}1 \textit{ at initial entry or any year firm}_i \textit{ switches niches,} \\ \textit{increment each year that firm}_i\textit{'s niche in year}_t \\ \textit{equals its niche in year}_{t-1}\end{matrix}$$

$$\textit{Niche density}_{it} = \textit{number of firms in firm}_i\textit{'s niche in year}_t$$

$$\textit{Niche density squared}_{it} = \textit{Niche density squared}$$

$$\textit{Munificence growth}_{it} = \left[\begin{array}{c} \dfrac{\left(\sum_i \textit{shipments}_i \textit{ in each niche}_t\right)}{\textit{Niche size}_t} \\ \textit{0 in first year a niche is in existence} \end{array}\right] - \left[\dfrac{\left(\sum_i \textit{shipments}_i \textit{ in each niche}_{t-1}\right)}{\textit{Niche size}_{t-1}}\right]$$

$$\textit{Stable rivals}_{it} = \frac{\textit{Total firms in firm}_i\textit{'s niche in year}_t}{\textit{Total of same firms in firm}_i\textit{'s niche in year}_{t-1} \textit{ and in year}_t}$$

$$\begin{array}{c}\textit{Differentiation across} \\ \textit{niches}_{it}\end{array} = \begin{array}{c}\textit{Z-score of squared euclidean distance based on cluster} \\ \textit{variables}^{e} \textit{ (Z is calculated using population } \mu \textit{ and } \sigma\textit{)}\end{array}$$

$$\textit{Density of other niches}_{it} = \begin{array}{c}\textit{Number of firms in the population} - \textit{number of firms in} \\ \textit{firm}_i\textit{'s niche in year}_t\end{array}$$

$$\textit{Performance}_{it} = \frac{[(\textit{Dollar sales}_{it}) - E\,(\textit{dollar share}_{it}) \times \textit{GDP deflator}_t]}{\left(\sum_i \textit{dollar sales}_{it}\right)}$$

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[a] In our analysis, a brand is a firm. Since there was a large number of firms in many years, we used dummy variables for the ten firms with the top market shares 1982–91 and a category dummy for all others. The theory is that a brand effect is associated with the market share leaders but it is minimal when share is in the range of hundredths of a percent. Firms with their own dummy variables are IBM, Tandy, Groupe Bull, Compaq, Commodore, Atari, HP, NEC, Epson, Packard Bell, and NCR. The last three are tied in rank.

[b] Table 1 gives the technology generations.

[c] *Category dummy* × *price* was included to assure a different slope and cross-elasticity for each category.

[d] Source: *Economic Indicators*, Council of Economic Advisers (1995).

[e] See Appendix A for a description of the niche clustering algorithm.

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A COMMUNITY-LEVEL ANALYSIS OF SOURCES AND RATES OF TECHNOLOGICAL VARIATION IN THE MICROPROCESSOR MARKET

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This research sought to identify the sources and rates of technological variation in an industry using a community-level framework. Using data on all merchant producers of microprocessors from 1971 to 1989, I found that new entrants were the sources of most new designs. The rate at which design sponsors entered the market follows organizational ecology's density-dependence model. Further, increasing market concentration increased the entry rate of new firms, most of which sponsored architectural innovations, suggesting that the emergence of a dominant design may paradoxically promote new approaches and technologies.

What are the organizational sources of technological variation in industry, and what factors determine its rate of occurrence? Although studies have documented the effects of technological change on mortality (Barnett, 1990), organizational performance (Teece, 1988), and industry structure (Pavitt, 1984), technology has generally been viewed as arising outside of organizational processes, with its sources either undetermined or assumed to be random and stochastic (Basalla, 1988; Tushman & Anderson, 1986). In this study, I uncover the organizational and community-level processes that govern the sources of technological variations and their rate of emergence.

One influential model of technological change is the dominant-design theory (Tushman & Anderson, 1986; Utterback & Abernathy, 1975), according to which technological change in an industry occurs through an evolutionary pattern of variation, selection, and retention of designs, which are defined as particular configurations of technical components. Variation is provided by technological breakthroughs, or discontinuities, which occur stochastically and randomly and are followed by a period of intense competition between designs with different product architectures (Henderson & Clark, 1990). This period of experimentation ends with the selection and retention of a dominant design, a single architecture that becomes widely

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accepted as the industry standard, so that other paths of product innovation are, for the most part, abandoned (Anderson & Tushman, 1990; Sahal, 1981). Once this design emerges, future technological change is confined to incremental change that elaborates the basic design until the next discontinuity restarts the cycle.

The dominant-design theory underscores the importance of social and organizational processes for selection and retention of designs but neglects the effects of these factors on technological variation itself. Such variation can occur when any new design that competes with other designs in a market is introduced—even if the design does not represent a technological discontinuity. Because the technological variation of competing designs is the raw material upon which selection and retention operate, determining the source and rate of occurrence of these designs is a key theoretical issue. Determining the source of designs requires an examination of the context from which they emerge.

Each introduced design is supported by a community of organizations that have a stake in the design, and the emergence of a dominant design results from key stakeholders converging upon and supporting a single design. For instance, the IBM personal computer design is supported not only by IBM, but also by clone manufacturers and firms producing compatible hardware and software. These technological communities can have profound effects on the success or failure of designs. Many analysts argue that IBM's decision to allow other manufacturers to clone its personal computer design is a key reason why IBM-compatible products dominate the market. Similarly, the extent of organizational support that the IBM standard enjoys undoubtedly reduces technological variation by discouraging other potential entrants from introducing new, incompatible personal computer designs. I examined these community-level dynamics, which are the context of the sources and rates of technological variation, with data on the microprocessor market. Because of its rapid rate of technological change and the interplay between competing communities supporting alternative designs, this market is ideal for examining how interdependencies between firms and communities shape technological variation.

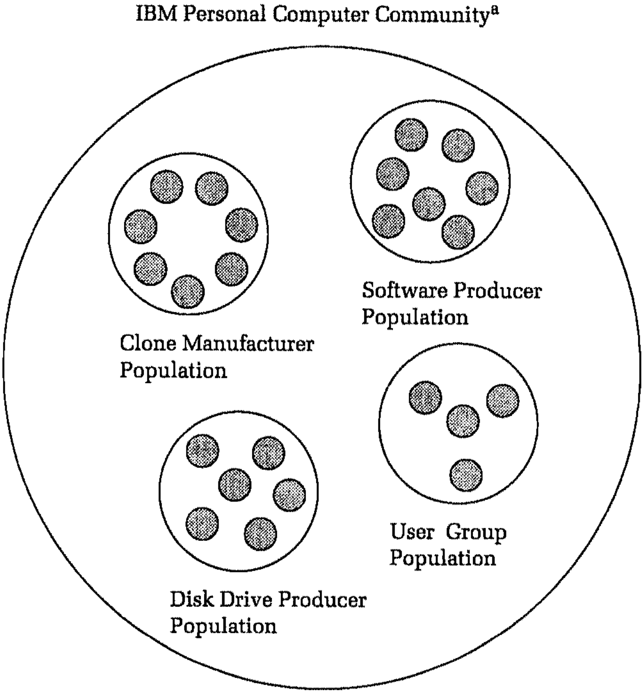
ORGANIZATIONAL COMMUNITIES

The competition between competing technologies and designs can be viewed as a competition between rival technological communities, with each community consisting of a set of interdependent populations (Astley, 1985; Hawley, 1950). Communities supporting designs coalesce either around the designs themselves or around the organizations that have the proprietary interest in given technologies or designs (Wade, 1995).

A basic design imposes a way of doing things, thereby defining a trajectory that future products in that design will follow. Accordingly, technological, or design, communities can be defined by grouping products that have some degree of hardware and software compatibility. A design's community consists of all firms that have a stake in or support any of the products associated with that design. Thus, as Figure 1 illustrates, the IBM personal computer design community consists of a variety of interdependent organizational populations, including the producers of the primary product (IBM and the clone manufacturers), producers of associated products, such as software, and even user groups. What the seven companies in the software population in Figure 1 have in common with the disk drive producers, for example, is that they support the IBM personal computer design with compatible products.

Alternatively, a technological community can be based on sponsorship. In the economics literature, a sponsor is an organization that holds a proprietary interest in a technology or design (David & Greenstein, 1990). A sponsor community consists of the sponsor and all organizations having a stake in any of its designs. Here, beyond the technical compatibility of the products associated with one design, socioeconomic ties between a sponsor and organizations affiliated with *any* of its designs bring the community together. For example, all organizations associated with any of Apple Computer's personal computer designs would be members of the Apple sponsor community.

FIGURE 1
Example of a Design Community[a]


IBM Personal Computer Community[a]
Software Producer Population
Clone Manufacturer Population
User Group Population
Disk Drive Producer Population

[a] Each dot represents a firm in the population.

The idea that reputation and social ties are important factors in a technological community recalls Granovetter's (1985) suggestion that the evolution of social ties between people and organizations can have a powerful influence on economic activity. Sponsor communities can each have customers who are accustomed to dealing with the sponsor's products and employees who value those relations apart from the technical characteristics of the product. For example, in the personal computer market, it has been suggested that IBM's early success was not due to technological superiority but to IBM's good relationship with corporate clients who had previously invested in IBM's mainframe computers (Steffens, 1994). In short, social ties between people and organizations are likely to be embedded in economic activity and "infused with value beyond the technical requirements of the task at hand" (Selznick, 1957: 17). Such is the case of a sponsor community, whose members may support a number of different designs.

One reason a community can form around a sponsor is that sponsors are likely to develop complementary assets that support a primary product (Teece, 1992). Although some of these assets, such as supporting peripheral products, are directly connected to the design, others are relevant to all of a sponsor's designs. For example, the success of Intel's 8080 microprocessor was not only due to the proliferation of supporting peripheral products, but also to Intel's marketing, sales, and manufacturing expertise (Teece, 1992). Similarly, IBM was able to sell its PCs directly to corporate customers who had previously invested in IBM mainframe computers by using its experienced sales force, a complementary asset.

It was unclear theoretically whether defining technological communities at the level of the design or of the sponsor would reveal more about sources and rates of innovation. Therefore, I tested the hypotheses developed below using both definitions of a community. A brief description of the microprocessor market provides the context of the study.

Context of the Study

The origin of the microprocessor market can be traced to Ted Hoff of Intel, who designed the chips for a new multifunction calculator for Busicom, a small Japanese calculator company. Previously, each function on a calculator required a logic chip specially designed for that task, and each new function that was added to the calculator, such as exponentiation, required another chip. As the number of functions climbed, coordinating and designing these chips became a daunting task. Hoff thought it would be more efficient if Intel designed a single chip with an instruction set that could be programmed to perform all the functions needed. The result was the 4004 chip, which was introduced in 1971. Intel successfully negotiated with Busicom for the right to market this chip in other areas. Busicom eventually faded from the scene and failed, while Intel started a new industry that it dominates to this day (see Jelinek and Schoonhoven [1993] for a history of this market). In the early seventies, quarterly sales in the microprocessor market were only several million. Since then, sales have grown tremendously; they were almost 600 million per quarter by the third quarter of 1989, the end of the study period.

Microprocessors are general purpose devices. They perform both the primary execution and control functions in a system. A microprocessor, which resembles and often is the central processing unit in a computer, requires peripheral products, such as memory and input and output devices, to create a working system. In combination with peripheral devices, a microprocessor allows communication with the outside world and other systems.

A related market spawned by microchip technology is the microcontroller market. A microcontroller is a stand-alone system. Usually, its instruction set is used to create a program that is permanently burned into the read-only memory (ROM) before the microchip is shipped to a customer. Microcontrollers are generally purchased in large quantities. For instance, a microcontroller might be used when an automobile needs a device solely to monitor oil pressure. On a continuum, microcontrollers are one step up from a dedicated logic chip in terms of flexibility. They are best suited for use in specialized but fixed tasks. By contrast, microprocessors are much more flexible than microcontrollers, allowing a user to modify and expand a system when a change occurs in the application. This study focuses on the microprocessor market only.

Firms generally pursue one of two strategies to enter the microprocessor market. First, a firm can design and produce an original microprocessor. A firm that creates one or more original designs is referred to here as a sponsor. A second strategy is to copy an existing microprocessor, in which case the firm is known as a second source. Because patent protection in the semiconductor industry is relatively weak, second sources sometimes copy designs without being authorized to do so. Often, a sponsor contacts a second source after the latter is already producing one of the sponsor's designs and eventually receives a nominal licensing fee (Swann, 1987).

Within the microprocessor market, a design community consists of the sponsor of a design and its second sources and of producers of products associated with the design because they share some hardware or software compatibility.[1] Thus, in 1975, the 4004 design community would have consisted of Intel, the sponsor, and National, a second source. Similarly, producers of Intel's 8008, 8080, 8085, and iAPX86 series, which shared some hardware and software compatibility, formed another design community. Table 1 shows all of the designs in the microprocessor market, their dates of introduction (by year and quarter), and their sponsors. For instance, it can be seen that Intel sponsored four different designs over the study period, which spawned four different design communities. In contrast, Intel was a member of a single sponsor community, consisting of Intel and the second sources that copied any of its designs.

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[1] A definitional problem arises when a firm other than an original sponsor designs a product compatible in some respects with the original sponsor's products but having a unique architecture that cannot be directly tied to any product in the original design community. I suggest that sponsorship by another firm is crucial and that the related product and its sponsor should be considered as part of a separate community. Each sponsor has some control over how easily its products can be copied, as well as over the future technological direction its products can take, and because the two sponsors are not always likely to have coinciding interests, a boundary between the two communities is likely to arise.

Of course, second sources make up only one population among those that support a particular sponsor's products in a community. Other populations of firms provide support in terms of providing compatible software and peripherals such as input-output devices. There is no a priori theoretical reason, however, to expect that these other populations will have effects different from that of the second source population. To keep the study to a manageable size, I did not include all these populations but, rather, gathered data only on sponsors and second sources, which form the core of the community. This research is therefore exploratory. Supportive results, however, even with data from only the core of the community, will indicate the value of studying whole communities in future research to understand the complexity of the process.

THEORY AND HYPOTHESES

Sources of New Designs

An important source of technological variation is the proliferation of new designs, each of which represents a potential technological trajectory for an industry. There are two possible sources of new designs: (1) new entrants and (2) firms that have previously created one or more designs. Identifying which source is more common and the rate at which designs originate from each provides insight into the organizational sources of technological variation. Such insight has practical importance because government policies can influence barriers to entry into a market. If most new designs originate from firms that have never before produced a design, policies that discourage entry into a market could lower the amount of diversity in a system.

Once a firm creates an original design, however, it is likely thereafter to produce improved versions that share at least some technical compatibility with its initial design, so as not to alienate customers, second sources, and suppliers of compatible products who have irretrievable investments in the architecture of the original design. Producing products that share some technical compatibility with earlier products is likely to be particularly important in industries with increasing returns, when the utility that a user derives from a good increases with the number of other users of the good (Katz & Shapiro, 1985). For example, as the number of telephones in use increases, so does the telephone's value to a given user: the user can talk to more people on the telephone. This same phenomenon occurs in the microprocessor market because of the wide variety of software and hardware that support a

TABLE 1
Summary of Sponsors and Designs in the General Microprocessor Market[a]

Intel[b]	**Mostek**	**RCA**	**Signetics**	**General Instruments**	**Digital Equipment**	**Novix**	**SUN (SPARC)**
4004 (71Q2)	5065 (74Q1)	1800 (75Q1)	2650 (75Q2)	CP1600 (76Q1)	T-11 (82Q2)	NC4016 (86Q2)	MB86900 (88Q1)
					|	|	S-20/25
8008 (72Q1)	**Motorola**[c]	1802	**National**	**Texas Instruments**	J-11	NC6016	CY7C601
|		|					LR64801
8080	6802 (74Q2)	1805/06	PACE (75Q3)	9900 (76Q2)	**NCR**	**Intergraph**[f]	
|	|			|			**MIPS**
8085	6808	**Matushita**	SC/MP (76Q4)	9980	NCR/32 (83Q2)	C100 (87Q1)	
|	|			|		|	R2000 (88Q1)
8088	6809	MN1600 (75Q1)	NSC800 (81Q1	99105	**Inmos**	**C300**	|
|	|						R3000
8086	68000	**Western Digital**	16000 (82Q1)	**Zilog**	T424 (85Q2)	**VLSI**	|
|	|		|		|		R6000
80286	68010	MP1600 (75Q1)	32000	Z80 (76Q3)	T800	VL86C010 (87Q2)	
|	|	|		|			**TRON**[g]
80286	68020	Pascal Microengine	**Electronic Arrays**	Z180	**AT&T**	**NEC**	
|	|						HB64016 (88Q1)
80486	68030	**Intersil**[d]	EA9002 (75Q3)	Z8000 (79Q2)	32100 (85Q3)	V60 (87Q2)	|
				|		|	HB32/100
iAPX432 (81Q1)	88100 (88Q2)	IM6100 (75Q2)	**Mos Technology**	Z80000		V70	
							Marconi
80860 (89Q3)	**Toshiba**		6500 (75Q3)	**Data General**[e]			
			|				MA1908 (88Q3)
Rockwell	TLCS-12 (74Q2)		6502	MN601 (76Q3)			
PPS-4			|	|			**AMD**
|			65SC802	MN602			
PPS-8			|	|			AM29000 (88Q4)
			65SC816	9440			
				|			
				9445			

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[a] Dates given in parentheses (year and quarter) are for first dates of full production. The microprocessors may have been produced in prototype quantities slightly earlier. Vertical lines connect products in the same design group. Companies in bold are the sponsors.

[b] The iAPX86 series used in the IBM personal computer is placed in the same design community as the 8085 because they have some software compatibility.

[c] The 68000 is placed in the same design group as the 6800 because they can use several of the same peripheral devices.

[d] Although the IM6100 is an implementation of DEC's PDP8 minicomputer, Intersil is considered to be the sponsor because it developed the microprocessor independently.

[e] Fairchild's 9440 and 9445 are placed in the same sponsor and design community as Data General's MN601 and MN602 because they are both implementations of Data General's Nova series of minicomputers. In addition, Data General fought a protracted legal battle with Fairchild claiming that its patents had been violated.

[f] The C100 was developed by Fairchild in 1987 but was sold to Intergraph later in the same year. Many of the individuals associated with the design also went to Intergraph.

[g] TRON is a standard that was cooperatively developed by major Japanese semiconductor companies and universities. Thus, there is not a single firm that can be identified as the sponsor.

microprocessor design. Similarly, in the personal computer market, IBM has an advantage over Apple because it has a larger base of installations. The greater the number of products sold within a given design, the more worthwhile it is for other firms to produce software and hardware associated with that design, which, in turn, makes the design more attractive to potential customers. Thus, a firm that produces a new design is giving up the benefits of its existing network of supporting products and the organizations that provide them. Moreover, because microprocessors require supporting products in order to function, a new design will render customers' investments in a previous design worthless if they want to upgrade their technology. Burgelman (1994) underscored this point, arguing that cultivating customer relationships in the microprocessor market is important because customers view the selection of a chip architecture as a long-term decision. Consequently, pursuing a strategy of frequently building incompatible designs is likely to yield lower returns than building on an existing design. This reasoning suggests

> *Hypothesis 1: Microprocessor designs are more likely to be introduced by firms that have not previously created original designs than by those that have pioneered previous designs.*

Entry Rates of Sponsors

When will a firm that has not previously introduced an original design be most likely to enter the market? If, as Hypothesis 1 suggests, this is the most common way that designs originate, understanding the conditions that determine the entry rate of sponsors is important because they are the most important source of technological diversity. Further, the entry of a sponsor with a new design signals the birth of a new technological community, which over time may be supported by a wide variety of organizations, including customers, suppliers of associated products, and even professional associations.

One factor that is likely to influence the rate of sponsor entry is the number of firms in the market. Hannan (1986) theorized that when a market first develops, increasing numbers of entrants encourage further entry, as barriers to capital acquisition fall and entrepreneurs begin to see the market as viable. The number of firms continues to increase until, at some point, no further returns to expansion in numbers occur, and competition among firms increases. In Hannan's model, at low levels of density (number of organizations), legitimation processes dominate, causing founding rates to rise. In contrast, at high levels of density, competition dominates, and founding rates fall. Support for the model has been found in populations of newspapers (Carroll & Hannan, 1989), labor unions (Hannan & Freeman, 1989), telephone companies (Barnett & Carroll, 1987), brewing companies (Carroll & Swaminathan, 1991; Carroll & Wade, 1991), and business interest associations (Aldrich, Staber, Zimmer, & Beggs, 1990).

As originally proposed, Hannan's theory of density dependence predicts the pattern of emergence of firms in an industry. Haveman (1993, 1994) suggested, however, that a firm's decision to enter a new market is similar to an entrepreneur's decision to found a new firm. In support of this assertion, she found that the entry rate of savings and loans associations into new product markets followed the pattern predicted by density-dependence theory. In an earlier study of this market (Wade, 1995), which investigated the rate at which communities attracted organizational support, I also found evidence supporting density-dependence theory.

A similar process might apply to the entry rate of sponsors into a technological market. Early on, when there are few alternative variations of a technology (e.g., few technological communities), customers and suppliers may be less likely to invest in the technology because they are uncertain that it will survive. Similarly, potential sponsors may be fearful of investing the resources needed to create a new design using an unproven technology. As the number of entrants into a market increases, and more alternative sources of the technology arise, however, customers and potential sponsors are likely to have increased confidence in its viability. At this point, the technology gains legitimacy, and the entry rate of sponsors would be expected to rise. This legitimation process may be particularly important for systemic technologies like microprocessors that require compatible associated components such as memory and input-output devices to function. If the technology perishes, customers lose their investments not only in the primary product, the microprocessor, but also in a wide range of other, associated products.

As density continues to rise, however, the technology becomes taken-for-granted and gains from the legitimation of the market cease. Competition overwhelms the legitimation effect, and the entry rate falls. Further, as Barnett (1990) suggested, the existence of many nonstandardized technological communities is likely to fragment an industry, making it difficult for different sets of products to work together. Thus, in an environment with many competing designs, customers may be less likely to invest in the technology because of fears of being stuck with a design that will lose in competition. All these factors should make it less likely for potential sponsors to enter the market, which suggests

> *Hypothesis 2: The rate of sponsor entry into the microprocessor market increases as the density of technological communities initially increases and then declines when the density reaches a high level.*

The rate at which sponsors enter the market is likely to be affected not only by the number of other communities in the market but also by the sheer number of firms supporting these communities as second sources. Because they copy existing designs, second sources effectively increase the production capacity of communities already in the market, enabling them to potentially serve more customers. A large number of second sources in the market may imply that there are large numbers of customers "locked in" to existing designs, creating poor opportunities for entrants sponsoring new designs.

Of course, a large number of second sources supporting a given design does not necessarily imply a large number of customers. Swann (1987) suggested, however, that strong early organizational support for a product signals its potential status as an industry standard, thereby increasing demand for the product and thus attracting more second sources. He found support for this argument in the microprocessor market in that relatively few products attracted most of the second sources and were the most successful. He concluded that as established products gain organizational support, it becomes more attractive for new entrants to become second sources rather than to market new designs. Thus,

> *Hypothesis 3: The greater the density of second sources supporting existing communities, the lower will be the entry rate of sponsors into the microprocessor market.*

Many authors characterize technological change in an industry as a battle to determine the dominant design (Tushman & Anderson, 1986; Utterback & Kim, 1986). The emergence of a dominant design is often described as a watershed event in an industry's history, and it can have powerful effects on interorganizational dynamics, particularly in an industry with increasing returns (Baum, Korn, & Kotha, 1995), such as this one. After the emergence of a dominant design, technical uncertainty decreases in a product class, economies of scale kick in, and many incremental innovations that elaborate and extend the dominant design drive subsequent technological progress (Abernathy & Utterback, 1982; Anderson & Tushman, 1990; Hollander, 1965; Myers & Marquis, 1969). Almost by definition, this process implies that as one or a few designs become increasingly dominant, the entry rate of sponsors will fall.

The emergence of a dominant design signals the emergence of a dominant-design community, since the design forms the center of the community. A similar process, however, should apply when technological communities are defined by sponsorship. If one sponsor's designs dominate the market, its high level of sales sends a signal to customers about the reliability and level of support that all its designs enjoy, which creates high entry barriers for sponsors of new designs. This suggests

> *Hypothesis 4: The emergence of a dominant technological community will decrease the entry rate of sponsors into the microprocessor market.*

The resource-partitioning model of organizational ecology, however, suggests an opposing prediction, namely, that the emergence of a dominant design may spur new firms to sponsor original designs. Carroll (1985) suggested that when a market is crowded early, participants vie for the widest possible resource base. Later, when scale economies dominate, the surviving generalists move toward the center of the market. This crowding of the generalists opens pockets of resources at the periphery, where specialists can thrive. One impact of the emergence of a dominant design is that it makes economies of scale an important competitive factor: after its emergence, production volumes markedly increase as vendors, suppliers, and customers adopt and support the design. Thus, because of the economies of scale present in this market, a dominant technological community would increase its costs significantly if it catered to smaller, more specialized niches that each had fewer customers than the primary niche. So the emergence of a dominant design or, correspondingly, an increase in concentration might lead to an increase in the number of sponsors whose designs cater to specialist applications.

Another reason that high concentration may lead to a resurgence in entry is that existing technological communities will increasingly be tied to their existing bases of users. For example, a sponsor with a large base of users who have substantial investments in a design is unlikely to make changes in its products that would compromise compatibility with earlier models. Consequently, even if a new approach would result in a significantly better performing but incompatible product, existing sponsors would be unlikely to produce it, thereby creating opportunities for specialists serving the high end of the market. The above arguments suggest

> *Hypothesis 5: The emergence of a dominant technological community will increase the entry rate into the microprocessor market of sponsors serving specialized markets.*

Although Hypothesis 5 seemingly contradicts the dominant-design model, support for it could be consistent with the model in light of the concept of architectural innovation. In an architectural innovation, the basic components of a technology are often unchanged, but the relationship between the components shifts (Henderson & Clark, 1990). In microprocessors, the dominant architecture up to now has been the complex instruction set code (CISC), which builds complex instructions into the hardware of the microprocessor. A new architecture introduced in 1985, close to the time when Intel gained 50 percent of the market, is the reduced instruction set code (RISC), which leaves out seldom-used instructions and thus allows designers to make chips smaller and faster. Because RISC microprocessors have very short, simple instructions, they require more software—software engineers may have to use several RISC instructions to accomplish what one CISC instruction could—but this liability is more than offset by their advantages in size and speed. RISC processors are not a technological discontinuity in the usual sense, because they use the same basic technology as CISC processors; but RISC could be considered an architectural innovation in that the links between the software and hardware components of the processor have changed.

According to Henderson and Clark (1990), existing firms trying to copy an architectural innovation face a difficult problem because their knowledge of an old system may make it difficult for them to adjust to a new one; their old architectural knowledge, embedded in their organizations, can cause them to misunderstand a new architecture and all its implications. Architectural innovations thus may allow new entrants, unencumbered by old knowledge of questionable value, to make inroads into an industry.

Viewing RISC architecture as an architectural innovation suggested an alternative explanation for an increase in the number of entries of sponsors using the RISC architecture following the emergence of a dominant design. If architectural innovations do occur under high concentration, it may indicate that entry barriers for firms with new technical approaches are low under these conditions. Because such entrants are specialists, in that they serve the high-performance end of the market, such a result would also be consistent with resource-partitioning theory. Consequently, I determined that if I found the emergence of a dominant design increased the rate of sponsor entry, I would carefully examine the sponsors entering after its emergence. If these new entrants were specialists and if many of them used RISC technology, it would suggest that increasing concentration leads to the emergence of new technological approaches. In testing the hypotheses, I controlled for overall market sales, since it is reasonable to expect that larger markets will attract more entrants. In addition, sales growth over the previous period was included, when the data were available, to control for microprocessor demand.

DATA AND METHODS

The data cover all firms that produced microprocessors between 1971 and 1989. The number of firms in this market rose from 1 in 1971 to over 35 by the end of 1989. Many entrants were new firms specializing in microprocessors when they entered the industry. Others, such as Motorola, were active in other markets before producing microprocessors. The relatively small number of events precludes analyzing these two types of entry separately.

Data on the timing of each firm's participation in the microprocessor market was obtained from *IC Master* and a leading data research firm in the industry.[2] *IC Master,* an annual publication used by engineers to choose integrated circuits that meet their performance needs, has been published since 1976. As early as 1976, *IC Master* distinguished between the markets for microprocessors and microcontrollers, which industry insiders whom I interviewed also viewed as separate markets. In rare cases, the line between microprocessors and microcontrollers was blurred, and these were resolved by consulting numerous sources. For instance, the 1750 family, which implements the MIL-STD architecture for airborne computers, was judged not to be a general microprocessor because of its specialized nature and because at least one member of this family was a stand-alone system, a characteristic of microcontrollers. In addition, many of the products using this architecture were designed for specific military systems.

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[2] The data were obtained on the condition that the name of the data research company be kept confidential.

Before 1983, *IC Master* included not only performance data on a device, but also the quarter in which the product was first shipped. From 1983 onward, a yearly date could be inferred from the years that a firm's devices were included in the volume. Entries were defined as occurring when a firm first put a product into production; exits were recorded when shipping ceased.

Because *IC Master* included the date that a product was first shipped, it was possible to extend the data back to the beginning of the industry in 1971. I carefully examined the secondary sources named above, as well as industry histories, to insure that no products had disappeared prior to *IC Master*'s first publication in 1976. Because the early history of this industry is well documented, it is unlikely that I missed any designs.

The data research firm analyzes and collects data on the microprocessor market and sells this information to firms in the industry. The data are worldwide in scope and their accuracy is aided by the fact that the firm has offices throughout the world, including Japan and Europe. The firm's data include unit sales by device, firm, and quarter. These quarterly data were collected by surveying companies and industry experts and extend from 1975 through 1989.

By combining the two primary sources, I was able to construct a list of the products in the industry and the timing of their entries and exits. Using multiple sources to determine entry dates is essential in this market because firms close to production have an incentive to publicize their products so that they will be considered for purchase. In rare cases, this could lead to a listing appearing in *IC Master* or another source before the firm is actually ready to ship the product. Data from the research firm are less subject to this inaccuracy, since the firm uses a variety of sources to estimate shipments. Using two primary sources of data made it possible to pinpoint entry dates and lowered the probability that an incorrect date would be used. I used a large number of secondary sources and my own best judgment to resolve any conflicts between the two primary sources and to ensure that the dates were as accurate as possible. Secondary sources consulted included *F&S Indexes, EDN*'s Annual Microprocessor Survey (1974–89), *Electronics* (various years), *Microprocessors and Microsystems,* and various published historical accounts of the industry.

Occasionally, the secondary sources listed an announcement of a design that was not listed in the two primary sources. In most cases, these designs should not be grouped in the general merchant microprocessor market because they were either intended for exclusively military purposes or were only produced for in-house products. In a few cases, however, one of the secondary sources announced a design that appeared to be a general microprocessor. These designs had to be excluded from the analyses because it was unclear if they had ever been put into full production or were simply announcements of designs that were never produced.[3] Thus, one limitation of the data is the possibility that a design may have been excluded from the analyses in error if it was produced in extremely small quantities for a short time. It should be noted, however, that *IC Master* and the research firm are the most comprehensive sources available.

Whenever possible, entry and exit dates were calculated to the quarter. In the few cases in which only a yearly entry or exit date was available, I randomly assigned the event to a quarter during the year. For the 30 communities defined at the level of the sponsor, three entry dates and seven exit dates could only be determined to the nearest year and were randomly assigned to quarters. I used a similar procedure for identifying entry and exit dates for second sources. Among the 53 second sources, four ending dates and six starting dates were randomly assigned to quarters within the year.

Measures

The *density of design communities* was operationally defined as the number of designs currently in the market and was updated quarterly. The *density of sponsor communities* was measured as the number of sponsors in the market and was updated quarterly.[4] To calculate the *density of second sources supporting design communities,* I determined the number of second sources copying each design, then computed the number of second sources supporting design communities by summing the number of second sources copying each design across all designs. To calculate the *density of second sources supporting sponsor communities,* I determined the number of second sources copying any of the designs of each sponsor. The number of second sources supporting sponsor communities was then computed by summing the number of second sources associated with each sponsor across all sponsors.

For *microprocessor sales,* I obtained yearly product prices from 1974 to 1989 from *EDN*'s Annual Survey of Microprocessors. Because this issue was published in November, I assumed the prices to be for the fourth quarter of each year. These prices were interpolated assuming a constant growth rate to obtain estimated quarterly prices. *EDN* gave prices for several variations and different quantities of each product; I used the price for the basic model in the highest quantity given, because many customers would purchase in high volumes, and this would therefore be the most reasonable price. If a basic model could not be identified, I used the lowest price given. An expert at a leading microprocessor firm suggested this procedure, noting that actual prices are usually at the lower end of advertised prices.[5] I then multiplied these prices by quarterly unit shipment data for the products provided by the data research firm to obtain sales measures for each product from 1975 through 1989.[6] From this set of calculations, I constructed a total sales measure for the industry and for the individual communities.

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[3] One microprocessor listed by the research firm with an incomplete part number was also excluded because I could not identify it even after consulting with the research firm.

[4] In a few cases, the organization that originally designed the microprocessor exited the market or was acquired. In these cases, the sponsor community was assumed to continue as long as any firms continued to produce the microprocessor. For example, MOS Technology originally designed the 6500 series but was taken over by Commodore. When Commodore exited the merchant market, several other producers continued to produce this design.

Unfortunately, unit sales information from the data research firm covered only 20 of the 30 communities. Upon closer examination, it appeared that nearly all of the excluded communities were extremely small. Besides unit data, the research firm also published microcomponent sales data for firms in the industry, which includes sales of microprocessors, microcontrollers, and peripheral devices. In these data, the research firm estimated the total microcomponent sales of firms not included in their survey. This number ranged from under 1 percent to 3 percent, with an average of 1.25 percent.

Because the microprocessor sales figures that I computed were partially derived from the research firm's unit data, this average percentage is probably a good estimate of the missing communities' share of total microprocessor sales. In fact, this percentage probably represents an upper bound, since microprocessors are the most visible of the three markets. Thus, the initial estimated microprocessor sales were assumed to make up 98.75 percent of the actual sales. The remaining 1.25 percent was split equally among the missing communities each quarter. Although these estimates are crude, more complicated variations are not likely to affect the results, because these sales are low compared with the sales of the other, larger firms and communities. In short, the variation in sales between the firms with missing sales data was extremely small compared with the sales of the industry. The results were not sensitive to changes in these assumptions. Moreover, the correlation between the total microprocessor sales estimated here and yearly sales figures that the research firm published from 1979 to 1989 was over .99. I deflated all sales figures using the average yearly manufacturing price index for the semiconductor industry. Quarterly sales figures were constructed from 1975 to 1989 for each community.

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[5] Occasionally, *EDN* stopped tracking the prices of older products. In these cases, I assumed the last price given remained constant throughout the rest of the product's life. This seemed reasonable since, in most cases, the price of these products had leveled off and would not be expected to decline further. In a few cases, the prices of some older products reported by *EDN* started to increase slightly over time. A marketing specialist at a leading microprocessor firm reported that this was a marketing tactic to encourage new customers to buy the most advanced product. He noted, however, that because firms did not want to alienate existing customers who had investments in these older products, actual prices charged were generally not increased. Consequently, for purposes of calculating sales, product prices were never increased over time but were assumed to remain at the lower price. In a few cases, the research firm only reported combined shipments of devices that were different products in the same design family. In these instances, I used the average price of the two products.

[6] Only yearly unit sales were available by product in 1975. Quarterly unit sales were estimated for this year by interpolating backwards using the unit sales of the product in the first quarter of 1976 as a starting point. A quarterly growth rate was selected so that the sum of the interpolated quarterly values in 1975 would equal the yearly estimate provided by the research firm. Only four products had yearly unit shipments recorded throughout their histories. These shipments were equally split within each year. Because few products were involved and their volume of shipments was low, changing interpolation assumptions does not affect the results.

Microprocessor sales data were not available before 1975; however, data on overall sales of microcomponents, which included microprocessors, microcontrollers, and peripheral devices, were available back to 1974. I used the growth in sales of microcomponents to extrapolate microprocessor industry sales values back to 1971. Because sales in 1975 were so small relative to those in later years, variations in the assumptions used for this extrapolation had no effect on the results. In other models, not shown here, the results did not change even if sales prior to 1975 were held constant at the 1975 level or were set at zero.

Emergence of a dominant design was measured in two ways. First, following Tushman and Anderson (1986), I coded a dummy variable one after a single technological community achieved a 50 percent or greater market share, and zero otherwise. In this market, Intel captured 50 percent of the market in the first quarter of 1984, largely because of the success of the IBM personal computer, which used Intel's iAPX86 series of microprocessors. This measure was derived from the community sales figures discussed above and was included in statistical models estimated over the time period 1971–89. To conduct a finer-grained analysis, I also computed the market share of the largest community (a calculation akin to a one-firm concentration ratio). This measure was computed separately for communities defined by sponsor and those defined by design.

Three measures of *sales growth* were computed. First, I computed overall sales growth using the total market sales figures. I also calculated the sales growth of the technological community with the highest sales (sales growth of dominant community) and the sales growth of other communities (sales growth of nondominant communities) separately because potential sponsors may have been deterred from entering the market when the largest community was growing rapidly. Rapid growth of the rest of the market may, however, signal increasing demand and encourage entry. Because sales were extrapolated prior to 1975, sales growth was only included as a control in models estimated over restricted time periods.

Methods

Hypothesis 1 predicts that firms that have not previously created original designs are more likely to introduce designs than those that have pioneered previous designs. I tested the hypothesis using a simple *t*-test for difference in means. The average number of new designs introduced by new entrants per year over the period was compared with the average number introduced by former sponsors.

Hypotheses 2, 3, and 4 were tested using event-count models. In analyzing the entry rates of sponsors, the population is the unit of analysis, since new sponsors will have no market history (Hannan & Freeman, 1989). Thus, the dependent variable was defined as a count of the number of sponsors entering in each quarter. Two analyses were performed, one for communities defined by design and one for communities defined by sponsor.

Hypothesis 5 predicts that the emergence of a dominant community will increase the entry rate of specialist sponsors. Because of the relatively low number of events in the data set, it was not possible to test separate event-count models for specialists and generalists. Consequently, I tested this hypothesis in two parts. First, a dummy variable indicating that one community captured over 50 percent of the market's sales was inserted into the model. A positive, significant value for this variable indicated that the emergence of a dominant design increased the entry rate of sponsors. After making this calculation, I qualitatively examined the sponsors entering the market after 1984, the year that Intel-compatible processors captured 50 percent of the market, to determine if most of them were specialists. If most of these entrants were specialists, it provided support for Hypothesis 5.

Because the emergence of a dominant design is associated with increasing concentration, I also tested Hypothesis 5 using the market share of the largest community. One method of determining whether concentration increases the rate of sponsor entry would have been to add these measures to models estimated over the entire time period. This would have been an unfair test, however, since according to the resource-partitioning model, niches will be opened for specialists only after economies of scale have been realized. Scale economies clearly do not dominate at the beginning of an industry's history, because product volumes are low. Because the history of microprocessors is brief, using these measures of concentration over the entire time period could skew the results; concentration is often artificially high in a population's early history when only a few firms occupy the market. For instance, Intel, the first entrant into the industry, practically owned the market in 1976, when a flood of entrants appeared on the scene. Thus, if concentration measures are calculated over the market's entire history, a positive finding may simply reflect entry associated with an emerging market, rather than resource partitioning.

According to resource-partitioning theory, models using concentration should be tested only after scale economies become significant. Some theorists have suggested that this occurs with the advent of a dominant design (Anderson & Tushman, 1990; Utterback & Suarez, 1993), because the cost of production of this design drops as the number of customers sharply increases. This reasoning sets 1984 as the date when scale economies prevailed and Intel-based microprocessors captured over 50 percent of the market, largely because of the success of the IBM personal computer. Consequently, I estimated models using the market share of the largest community for the period 1984 through 1989.

I used the Poisson distribution in analyzing the event counts. One problem with the Poisson model is that it assumes that the variance of expected event counts equals the mean. In many applications, however, event counts display overdispersion, a condition in which the variance of the dependent variable (the event count) exceeds the mean. In such cases, using the Poisson model can produce erroneously small standard errors for the estimated coefficients (Cameron & Trevidi, 1986; Hausman, Hall, & Griliches, 1984). This problem can be overcome by assuming a negative binomial distribution of events. In these data, however, using the negative binomial, as implemented in the program LIMDEP, did not improve the fit of the models, indicating that overdispersion was not a problem. Consequently, I used the Poisson model as described in the LIMDEP *User's Manual* (Greene, 1991).

All independent variables were measured one quarter before the dependent variable. This short time frame seemed justified because the environment of the semiconductor industry is volatile and dynamic (Brittain & Freeman, 1980; Jelinek & Schoonhoven, 1993) and fits Eisenhardt's (1989) description of a high-velocity environment. That the research firm collected quarterly data, as did *IC Master*, gives some indication of the speed of change in this industry. Moreover, a noted industry informant stated that quarterly data have a substantial impact on strategic decision making.

RESULTS

Organizational Sources of Designs

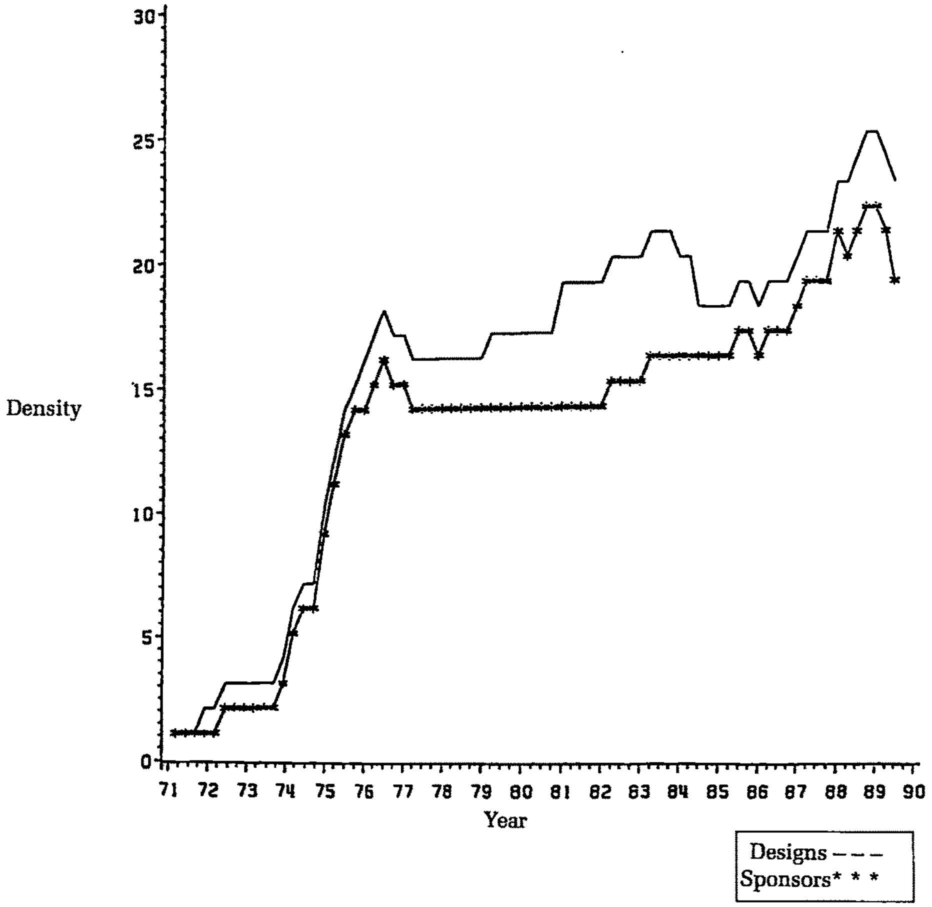
Hypothesis 1 states that the number of designs introduced by firms that have never previously introduced an original design will be greater than the number introduced by existing sponsors. Figure 2 shows the number of designs and the number of sponsors over the time period of the study. The number of designs is only slightly greater than the number of sponsors, indicating that new sponsors pioneered most designs.

Table 2 presents the relevant statistical results. Firms in the industry introduced a total of 38 different designs. All but 8 of these were introduced by new sponsors. New sponsors introduced significantly more designs per year ($p < .05$) than former sponsors. As expected, once a firm introduced a design, it tended to remain bound to it. Notably, of the 30 that introduced new designs, only 4 had previously been second sources, indicating that most new sponsors were also new to the market.

Entry Rates of Sponsors

Table 3 first shows results for the rate of sponsor entry when community is defined by sponsor. Thus, here a community is composed of a sponsor of one or more designs and all second sources of those designs. The model 1 results show that the number of second sources negatively affects sponsor entry. Consistent with Hypothesis 3, the existence of increased second-source support apparently decreases the probability of firms' entering with new designs. Model 1 also tests Hypothesis 2, which predicts that the effect of the number of communities on sponsor entry will be curvilinear—in the form of an inverted U. Although both the linear and the squared term are in

FIGURE 2
Density of Designs and Sponsors in the Microprocessor Market



the expected direction, only the linear term reaches full significance, and the squared term is marginally significant at about $p < .06$.

Model 2 is similar to model 1, except that it adds a dominant-design dummy (a variable that is coded one after a community captures over 50 percent of the market). Consistent with Hypothesis 5, but contrary to Hypothesis 4, the emergence of a dominant design spurs entry by sponsors. Further, in model 2, the linear term of community density remains statistically significant, and the significance of the squared term increases sharply ($p < .05$). In addition, the inflection point at which community density switches from increasing to suppressing entry occurs when there are about 12 communities in the market. This number is well within the observed range of the data. Thus, the density-dependence model does predict the rate of sponsor entry once the emergence of a dominant design is controlled for in the equation.

TABLE 2
Number of New Designs Introduced

Organizational Source	Total Designs Introduced per Year	Mean of Designs	Annual Standard Deviation	t^a
All sources	38			
New sponsors	30	1.58	2.17	
Former sponsors	8	0.42	0.61	−2.24*

[a] Test of difference in means by organizational source.
* $p < .05$

Model 3 reestimates model 2, defining communities by design level rather than by sponsor. Because only 8 of the 38 designs in the industry were pioneered by existing sponsors, the results should be similar. Including this model tests the sensitivity of the results to slightly different assumptions. As shown, this model is consistent with the earlier results, indicating that, at

TABLE 3
Results of Poisson Regression Models of Sponsor Entry, 1971–89[a]

	Community Defined by Sponsor		Community Defined by Design
Independent Variables	1	2	3
Density of communities	0.35* (0.18)	0.50** (0.18)	0.54** (0.19)
Density of communities squared	−0.02 (0.01)	−0.02* (0.01)	−0.02* (0.01)
Density of second sources supporting communities	−0.07* (0.03)	−0.16** (0.05)	−0.13** (0.06)
Dominant design dummy		3.22** (1.11)	2.82* (1.27)
Microprocessor sales	0.59** (0.28)	0.28 (0.30)	0.51 (0.38)
Constant	−1.57** (0.70)	−1.98** (0.71)	−2.45** (0.85)
−2 × log likelihood	103.8	92.5	91.1
Number of events	29	29	29
N	74	74	74

[a] Standard errors are in parentheses.
* $p < .05$, one-tailed test
** $p < .01$, one-tailed test

least in this sample, the particular specification of density used is of little consequence.

The finding that a dominant design's emergence increases the rate of sponsor entry is significant and deserves further investigation. This finding seemingly contradicts the dominant-design theory, yet it is consistent with resource partitioning (Carroll, 1985). As noted earlier, this result could also be consistent with the dominant-design model if RISC architecture, which emerged at close to the same time, is an architectural innovation. Eight of 11 of the sponsors entering the market after 1984 used this architecture. At the same time, however, consistent with Hypothesis 5 and resource partitioning, all the new entrants, including the 3 sponsors not using RISC, were specialists attempting to serve the high end of the market.[7]

To investigate the effects of sales concentration more closely, I computed the market share of the most dominant community. Because resource-partitioning theory only applies after scale economies become significant, these models using concentration were estimated from 1984 onward, the point at which the Intel community captured 50 percent of the market. Because this analysis begins late in the market's history, the market is already taken-for-granted and legitimate. Consequently, I included only the linear community density term in the models.

Model 1 in Table 4 shows results for the effects of concentration on sponsor entry with the effects of sales, second-source density, and sponsor-community density controlled. As expected, as concentration increases, so does the entry rate of new sponsors. The concentration measure remains significant ($p < .05$) even after sales growth is added as a control variable in model 2. Models 1 and 2, however, may be misspecified, since it is only the growth of communities other than the one containing a dominant design that would be expected to influence sponsor entry rates positively. To investigate this possibility, in model 3 I added the sales growth of nondominant and dominant communities. As can be seen, growth in sales of the nondominant communities has a positive effect on sponsor entry, and the sales growth of the dominant community has no effect. Importantly, the effect of concentration remains positive and significant. Models 4 through 7 are reestimations of models 1 through 3, defining the communities by design. The results are consistent with those of the earlier models. To test the sensitivity of the results to the assumption that resource partitioning applies when one community captures over 50 percent of the market, I also ran the analyses as-

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[7] The sponsors that did not use RISC technology were NEC, AT&T, and followers of the TRON standard. All three of these microprocessors were specialized for users for whom performance was the highest priority. The Hitachi microprocessor followed the TRON standard, a high-performance CISC technology that, Japanese developers suggested, would be a viable alternative to RISC. The AT&T chip was portrayed as a chip suitable for building top-of-the-line, minicomputer-like computing systems. Similarly, NEC's V60 and V70 were patterned after one of NEC's 36-bit mainframe computers.

TABLE 4
Results of Poisson Regression Models of Sponsor Entry after January 1984[a]

	Community Defined by Sponsor			Community Defined by Design		
Independent Variables	**1**	**2**	**3**	**4**	**5**	**6**
Density of communities	−0.08 (0.39)	−0.05 (0.41)	−0.51 (0.58)	−0.35 (0.42)	−0.39 (0.44)	−1.16 (0.82)
Density of second sources supporting communities	−0.10 (0.23)	−0.24 (0.27)	−0.45 (0.30)	−0.22 (0.27)	−0.43 (0.33)	−0.90* (0.51)
Market share of dominant community	18.43** (7.93)	16.52* (8.85)	34.10* (15.80)	18.00* (8.26)	17.70* (9.91)	54.00* (28.20)
Microprocessor sales	−0.02 (0.54)	−0.36 (0.65)	−0.27 (0.78)	0.42 (0.68)	0.14 (0.78)	0.55 (0.99)
Microprocessor sales growth		3.76 (2.51)			4.05* (2.46)	
Sales growth of nondominant communities			7.70* (3.72)			10.80* (5.21)
Sales growth of dominant community			0.34 (2.02)			−0.83 (2.40)
Constant	−8.09 (11.2)	−2.46 (11.4)	0.33 (11.1)	1.26 (12.8)	9.55 (13.7)	15.90 (15.1)
−2 × log likelihood	35.8	33.2	29.8	34.8	31.6	26.4
Number of events	11	11	11	11	11	11
N	23	23	23	23	23	23

[a] Standard errors are in parentheses.
* $p < .05$, one-tailed test
** $p < .01$, one-tailed test

suming that a dominant design emerges when a community captures over 40 percent and 60 percent of the market, respectively. The results do not change.

DISCUSSION AND CONCLUSIONS

In this study, I viewed competing designs as sources of technological variation. Both complementary and competing hypotheses were generated using predictions from the dominant design theory (Tushman & Anderson, 1986; Utterback & Abernathy, 1975), organizational ecology (Hannan & Freeman, 1977, 1989), and the economic literature on standards (David & Greenstein, 1990). In general, the empirical analysis shows strong support for the hypotheses.

As expected, most of the variation in the form of new designs came from first-time sponsors. Apparently, once a firm introduces a design, it remains bound to it. In a sense, the firm gets stuck on a technological trajectory (Dosi, 1982; Sahal, 1985). Since I found that most designs are established by new sponsors, the entry rate of sponsors is a good proxy for the extent of technological variation in the microprocessor market. Each sponsor essentially represents a possible technological trajectory and hence a source of technological variation. The finding that most new designs come from new sponsors also suggests that government policies that promote or discourage firm entry can have a large impact on the level of technological diversity in an industry. In addition, because new designs are a form of product innovation, governmental policies discouraging firm entry may cause a drop in the rates of innovation in an industry.

The entry rate of sponsors follows the density-dependence model of organizational evolution posited by Hannan (1986). At the beginning of an industry's history, an increase in the number of communities increases the industry's legitimacy. As numbers grow, the capital market increasingly sees the industry as viable, and access to capital increases. As communities become increasingly numerous, however, the industry becomes taken for granted, and competition dominates. Consequently, the entry rate of new sponsors with original designs falls. The legitimation phase of this process is similar to Anderson and Tushman's (1990) conception of an era of ferment following a discontinuity in which there is a proliferation of new designs. The important difference is that I explain the process underlying the phenomenon; previously, proponents of the dominant-design model have addressed only its consequences. This research also extends the density-dependence theory of legitimation and competition by linking it to technological variation. In effect, the density-dependence model may be able to explain not only the emergence of firms, but also the level of technological diversity in an industry.

Consistent with resource partitioning (Carroll, 1985), increasing market sales concentration leads to higher sponsor entry. Inspection of the entrants following the emergence of a dominant design suggests that the sponsors were specialists, which reinforces the resource-partitioning interpretation. All 11 of the new entrants' processors were specialized, serving the segment of the market in which performance had the highest priority.

The finding that increased concentration increases the entry rate of sponsors, coupled with the fact that most of these sponsors used a new architecture, suggests an intriguing possibility. Perhaps novel approaches are most likely to be attempted under high concentration. As economies of scale become important, dominant communities will tend to cater to the center of the market because they can reap the greatest cost savings by selling to the niche with the greatest number of customers. Selling to the center of the market is less important to smaller technological communities because they do not have the capacity or the user base to take full advantage of economies of scale. Moreover, because established sponsors are tied to their existing user bases, which have investments in their designs, they are likely to neglect the market periphery. Consequently, a period of concentration may be the time when new approaches are most likely to succeed. Increasing concentration should open up pockets of resources into which specialists, especially those with new approaches, can enter and thrive. This process seems to be occurring in the microprocessor industry.

Paradoxically, then, the emergence of a dominant design may bring with it the seeds of its possible destruction. This finding is potentially important to entrepreneurs because it suggests that barriers to entry for specialists with new technological approaches may be quite low during periods of high concentration. More research is needed to see if specialists advocating new technological approaches have higher life chances when they enter in periods of high concentration.

Overall, although these analyses have identified some sources and determinants of technological variation within an industry, the findings are limited in several ways. First, the number of firms in the market and, consequently, the number of entries and analyzable events was relatively small. Thus, although the results were generally strong and supported the hypotheses, they should be taken as suggestive rather than definitive.

Another limitation is that the extent to which these results are generalizable is unclear. The microprocessor market has been a high-growth industry throughout its history. In a low-growth industry with low technological potential, these results may not hold. The processes uncovered here may apply, however, to any industry in which increasing returns are important, particularly those in which the primary product is supported by a host of complementary products. Industries fitting this description are numerous and diverse and include video games, personal computers, video cassette recorders, and technologies for recording and playing music. For example, a large number of different designs have emerged in both the personal computer and video game markets, and many of these designs were supported by producers of a variety of complementary products. One interesting avenue for future research would be to contrast markets in which governments have an impact on the selection of the dominant design (e.g., high-definition television) with those like the microprocessor market, in which competition is the primary driver.

This study has illustrated some of the effects that community-level dynamics can have on the technological evolution of markets, yet the interorganizational relationships examined here represent only part of the relevant links. Future research could examine a richer set of interorganizational relationships within and between communities, such as relationships with professional associations, universities, customers, and suppliers of complementary products (Tushman & Rosenkof, 1992). Results from this study of the core of a technological community indicate that such research would be valuable. A community-level framework may provide researchers with a useful empirical and conceptual tool for understanding the complexities of technological evolution.

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RESEARCH NOTE

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IS SLACK GOOD OR BAD FOR INNOVATION?

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This article suggests that there is an inverse U-shaped relationship between slack and innovation in organizations: both too much and too little slack may be detrimental to innovation. Two related mechanisms governing this relationship are proposed: Slack fosters greater experimentation but also diminishing discipline over innovative projects, resulting in the hypothesized curvilinear relationship. Comprehensive worldwide data on 264 functional departments of two multinational corporations support the prediction.

Innovation and slack are concepts at the very core of organization theory. Innovation has been an outcome of central interest to organization theorists because it is vital for organizational adaptation and renewal. Organizational slack has long been used to explain diverse organizational phenomena, including goal conflict, political behavior, effectiveness, and innovation itself. Both constructs have received much attention in recent years. In an increasingly dynamic world, firms are being forced to become more innovative. At the same time, organizational slack has come under sharp scrutiny as organizations facing increasingly intense global competition feel pressured to eliminate all forms of slack. These two countervailing forces suggest a potential paradox. If slack is a form of inefficiency but also essential for innovation, organizations run the risk of eliminating slack to a point that undermines their capacity to innovate.

This dilemma raises the research question that is at the heart of this work: What is the relationship between organizational slack and innovation? The literature provides no clear answers because theorists stand divided on whether slack facilitates or inhibits innovation. Proponents of slack argue that it plays a crucial role in allowing organizations to innovate by permitting them to experiment with new strategies and innovative projects that

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might not be approved in a more resource-constrained environment (Cyert & March, 1963: 278). Opponents of slack counter that slack diminishes incentives to innovate and promotes undisciplined investment in R&D activities that rarely yield economic benefits (cf. Jensen, 1986, 1993; Leibenstein, 1969). According to this view, slack encourages the pursuit of pet projects by agents who show little regard for the interests of the principals they serve.

We argue that one way to reconcile this theoretical debate is to recognize that the relationship between slack and innovation is curvilinear—too little slack is as bad for innovation as too much slack. Building upon areas of agreement among the proponents and detractors of slack, we propose organizational slack's impact on experimentation and on the control placed on experimentation lead to the hypothesized relationship. Too little slack inhibits innovation because it discourages any kind of experimentation whose success is uncertain. Equally, too much slack inhibits innovation because it breeds complacency and a lack of discipline that makes it likely that more bad projects will be pursued than good. Taken together, these ideas suggest that an intermediate level of slack is optimal for innovation. Empirical support for these arguments comes from data on innovation and slack obtained from department-level managers in the subsidiaries of two multinational companies. We also examined the influence of contextual and organizational factors on this proposed relationship.[1]

WHAT IS SLACK?

We define slack as the pool of resources in an organization that is in excess of the minimum necessary to produce a given level of organizational output. Slack resources include excess inputs such as redundant employees, unused capacity, and unnecessary capital expenditures. They also include unexploited opportunities to increase outputs, such as increases in the margins and revenues that might be derived from customers and innovations that might push a firm closer to the technology frontier.[2] Further, slack can be deployed in various ways. A firm can use slack resources to respond to uneven performance (Kamin & Ronen, 1978) or to such contingencies as budget cuts or environmental jolts (Meyer, 1982), as well as to engage in slack search, or experimentation (Levinthal & March, 1981).

It is important, as Sharfman, Wolf, Chase, and Tansik (1988) urged, to specify slack in terms of ease of recovery or employability in the future. They contrasted high-discretion (easy-to-recover) and low-discretion (difficult-to-recover) slack. Similarly, Singh (1986) distinguished between unabsorbed slack, which is easy to recover, and absorbed slack—which is not easy to recover. Implicit in these distinctions is the time frame over which resources can be redeployed. In this work, we focused on short-term slack: resources of any kind that can be recovered to influence performance over a typical temporal cycle to which managers' activities are entrained. Given that budgets and performance reviews typically follow an annual cycle, we defined short-term slack as excess resources that can be recovered within a year. Our focus was on short-term, or unabsorbed, slack because such resources should be more easily deployable in support of innovative activity than long-term, or absorbed, slack.

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[1] A longer version of this article is available from the authors.

[2] Notions of what constitutes slack have varied widely (see Bourgeois [1981] and Lant [1985] for comprehensive reviews). The conceptual and empirical difficulties with defining slack have been an obstacle to research on this topic.

Even though the foregoing discussion has been primarily at the organization level, notice that our definition of slack applies across levels, because it captures the extent to which any unit (be it an individual, a department, a function, a division, or a firm as a whole) has excess resources that can be marshaled to meet internal or external contingencies.

The Case for a Positive Relationship between Slack and Innovation

Why does slack exist? Cyert and March (1963) provided the seminal answer to this question. They argued that slack exists because it plays a crucial and vital role in resolving latent goal conflict between political coalitions in organizations and thus prevents them from breaking apart. Building upon these original insights, scholars have argued that organizational slack is an important catalyst for innovation for two reasons—slack causes relaxation of controls and represents funds whose use may be approved even in the face of uncertainty. Slack allows pursuit of innovative projects because it protects organizations from the uncertain success of those projects, fostering a culture of experimentation (e.g., Bourgeois, 1981). Slack resources permit firms to more safely experiment with new strategies by, for example, introducing new products and entering new markets (Hambrick & Snow, 1977; Moses, 1992). Moreover, slack facilitates innovation by allowing slack search, or the pursuit of projects that don't appear to be justifiable in terms of internal market controls but have high potential in the view of scientists or other corporate champions (Levinthal & March, 1981; March, 1976). Although such projects often fail, they sometimes fortuitously yield positive results that can be of great benefit to a firm. The literature on innovation is replete with stories of chance discoveries that resulted from slack search, such as the much-celebrated discovery of Post-it notes at 3M (Mokyr, 1990).

Following such logical arguments in favor of slack, in most empirical studies on the organizational determinants of innovation, researchers have included slack as a variable and in some cases shown it to have a positive effect (cf. Damanpour, 1987; Delbecq & Mills, 1985; Lant, 1985; Majumdar & Venkataraman, 1993; Singh, 1986; Zajac, Golden, & Shortell, 1991; Zaltman, Duncan, & Holbeck, 1973).

The Case for a Negative Relationship between Slack and Innovation

Scholars, especially organizational economists such as Leibenstein (1969) and Williamson (1963, 1964), have adopted a more hostile view of slack. They view it as synonymous with waste and as a reflection of managerial self-interest, incompetence, and sloth rather than as a buffer necessary for organizational adaptation. Like Cyert and March (1963), these scholars start by characterizing firms as coalitions of competing interests. However, they contend that the proper way of thinking about these competing interests is to view them as a system of nested principal-agent relationships in which agents may accumulate slack to pursue their own interests rather than act in the interest of the organizations (Antle & Fellingham, 1990; Jensen & Meckling, 1976).[3] The top managers of a firm can be thought of as agents acting on behalf of the shareholders, or principals. Similarly, divisional managers can be thought of as agents acting on behalf of top management, and so on throughout the management hierarchy.

Organizational economists generally have not viewed slack as useful for resolving principal-agent conflicts. They have argued that the right way to resolve these conflicts is to structure incentives in ways that align the interests of principals and agents. Slack, in their view, is an unnecessary cost that should be eliminated.

Opponents of slack thus view it as a sign of inefficiency that detracts from the overall value of a firm. Leibenstein (1969) even coined the felicitous term *X-inefficiency* to highlight the discrepancy that slack creates between actual output and maximum output for a given set of inputs. Moreover, unlike advocates of slack, its detractors argue that excess slack may actually hurt innovation, and hence adaptation. Jensen (1986, 1993), for instance, argued that firms that have a high amount of slack often invest it in dubious projects, such as pet R&D projects and unrelated acquisitions.

In sum, these theorists have suggested that although excess slack undoubtedly spurs R&D expenditures that lead to the pursuit of many new projects, very few of these projects actually translate into value-added innovations for firms, because the loose controls placed on these projects allow decision makers to make choices that "accord better with their own preferences than with economic considerations" (Child, 1972: 11).

An Argument for a Curvilinear Relationship between Slack and Innovation

Credible cases can be made for and against the innovation-enhancing benefits of slack. Rather than weigh in on one side of the debate or the other, we would like to propose a reconciliation of these perspectives. In short, we suggest that the relationship between innovation and slack is curvilinear, or inverse U-shaped.

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[3] In this model, conflict arises because agents do not always have the incentive to act in the best interests of the principals, who typically don't have all the information necessary to monitor their agents' performance accurately. Agents can take advantage of this information asymmetry and act in their own interests. Indeed, Williamson (1963, 1964) argued that, left to their own devices, agents are primarily motivated to build empires for themselves.

This proposition rests on the following series of interrelated observations and arguments. The first thing to observe is that both the advocates and opponents of slack agree that slack promotes experimentation and the pursuit of new projects. For innovation to occur, organizations must cope with the uncertainty associated with innovative projects (Mansfield, 1963). This intrinsic uncertainty makes it difficult to gauge ex ante the net present value (NPV) of such projects. Persistence and "patient money" can not only foster innovation, but can also provide the flexibility necessary to adapt resource allocation levels as projects progress over time. Slack provides a pool of resources that can ease adaptation to the ebbs and flows of the innovation process. Slack also frees managerial attention, another scarce resource (Cyert & March, 1963). In organizations that have little slack, managerial attention is likely to be focused first and foremost on short-term performance issues rather than on more uncertain innovative projects. For all the abovementioned reasons, the number of new initiatives undertaken undoubtedly increases as slack increases. Of course, the relationship may not be linear over the entire range of slack. We expect diminishing returns from experimentation as slack increases because of diminishing availability of possibilities for innovation. The positive relationship between slack and experimentation is thus one factor that determines the relationship between slack and innovation.

An opposing dynamic that needs to be simultaneously considered is the diminishing discipline that is placed on increased experimentation as slack increases. As slack increases, the discipline that is exercised in the selection, ongoing support, and termination of projects becomes lax (e.g., Jensen, 1993; Leibenstein, 1969). With increasing slack, projects with high risk and negative NPV may be funded simply because the resources exist to indulge agents for whom these are pet projects. Not only may bad projects be initiated, continual, or escalating, commitment to these projects might occur because the existence of slack makes it difficult to justify termination of someone's pet project (Staw, Sandelands, & Dutton, 1981). As Cyert and March (1963) pointed out, in times of slack, negotiations are not as intense and managers tend to be less stringent in demanding that projects meet their forecasted milestones. The lax discipline around resource allocation that slack fosters increases both the risk that poor projects will not be terminated even in the face of negative information, and the risk that projects will be abandoned simply because someone ran out of energy, got bored, or ran into a tough problem. Thus, excess slack can result in both type I (selecting projects that should not have been funded) and type II (stopping projects that should have been continued) errors. In sum, we expected the relationship between slack and discipline to be negative.

Though we had no direct indicators of degree of experimentation or discipline in our study, theoretically we contend that if we put these two countervailing forces together, a curvilinear relationship between slack and innovation will emerge. Slack promotes greater experimentation but also promotes diminishing levels of discipline. Since adequate levels of both experimentation and discipline are requisites for innovation, we expected slack to have a nonlinear influence on innovation. This prediction suggests that there is an intermediate level of slack in any given organizational setting that is optimal for innovation and leads to our main hypothesis.

> *Hypothesis 1: The relationship between organizational slack and innovation is inverse U-shaped.*

METHODS

Sample

A significant question associated with studying the relationship between innovation and slack is level of analysis. Measuring slack or innovation at the firm level, although useful in making cross-organizational comparisons, can mask vast differences that may exist within a firm. Prior research has shown that in large, multinational organizations, such as multinational corporations (MNCs), intraorganizational differences can be greater than interorganizational differences (Ghoshal & Nohria, 1989). Accordingly, we decided that the most appropriate level at which to study this relationship was organizational subunits with clearly defined financial and administrative boundaries, such as departments within multinational subsidiaries. Such settings are rife with classic competing coalition and agency problems (Nohria & Ghoshal, 1994). Department managers have local knowledge and are likely to know good projects from bad. But their interests may not always be aligned with those of their principals because the department managers may seek to accumulate slack, either to pursue their own pet projects or to build buffers against unexpected contingencies. Thus, we were likely to find considerable variance in amounts of slack across the departments of MNCs, making them a rich setting in which to explore the relationship between slack and innovation.

Data were obtained through a self-report questionnaire mailed to department managers at the national subsidiaries of two major multinational corporations, one European and the other Japanese. Both firms are among the largest and most diversified MNCs in the world, but we focused our study on the consumer electronics business, in which the two companies competed directly worldwide. In this business, the firms were broadly comparable in terms of size, geographic scope, and competitive position.

These data were collected as part of a larger study on the organization of MNCs described in detail elsewhere (Bartlett & Ghoshal, 1989). The response of 178 departmental managers from 14 national subsidiaries in the Japanese firm and 78 departmental managers from 8 national subsidiaries in the European firm were complete and usable. Each subsidiary had about the same number of departments, including manufacturing, marketing, R&D, finance, and other administrative functions. Given that one of the major sources of variation in the characteristics of the departments in our sample was the subsidiary to which they belonged, for each corporation we chose a sample representative of the full range of the MNC's subsidiaries in consultation with three corporate managers from the firm responsible for the global consumer electronics business. These managers were also asked to complete a survey designed to capture differences among subsidiaries and their relationships with corporate headquarters. This selection procedure ensured that we had departments located in small and large subsidiaries, in advanced and developing nations, and in challenging and placid environments.

Drawing on lists furnished by the corporate headquarters, we mailed questionnaires to every departmental manager in each selected subsidiary. In both firms, these departments represented subunits with clear boundaries and independent budgets with specific goals and resources available. The response rate was 87 percent in the European firm and 93 percent in the Japanese firm. In no subsidiary was there a response rate of less than 83 percent.

Measures

As prior research has yielded no definitive measure of either innovation or slack, the issue of measuring both these constructs is mired in acrimonious controversy. Despite this challenge, we consider it important to empirically uncover some of the mysteries associated with slack and innovation. We are confident about the legitimacy of our measures (their pros and cons are discussed below) and hope this study brings new conceptual clarity to the vexing problems of measuring slack and innovation in organizations.

Innovation. Innovations are, by definition, unique—one is rarely commensurable with another (Damanpour, 1987; Kimberly & Evanisko, 1981; Van de Ven, 1986). Keeping these difficulties in mind, we defined innovative accomplishments very broadly to include any policy, structure, method or process, product or market opportunity that the manager of the innovating unit perceived to be new. This definition was first advanced by Schumpeter (1926) and has been employed subsequently in several studies, including the empirical work of Zaltman and colleagues (1973) and Kanter (1983). Although Daft (1982) suggested keeping technical and administrative innovations distinct, we joined with Van de Ven (1986), who argued that making such a distinction results in an unnecessarily fragmented classification of the innovation process. We adopted this very broad definition of innovation because our aim was to capture the extent to which each department was responsible for generating any form of new knowledge that could benefit an MNC. This definition also captures the spirit in which the concept of innovation has been used in the MNC literature (Ghoshal & Bartlett, 1988; Hedlund, 1986).

To address the problem of the incommensurability of the different types of innovations that come under the ambit of our definition, we focused on the tangible economic benefits of innovations. We asked each respondent to describe and estimate the total economic impact (the yearly savings and or additional revenues generated in millions of dollars) of each of the three most significant innovations his or her department had introduced during the last year. We could thus compare the innovativeness of a finance department that came up with a new hedging instrument to protect its firm from exchange rate fluctuations with the innovativeness of an R&D department that came up with a process innovation that improved manufacturing yields by 3 percent (these are both real examples from the data).[4]

We also tested the robustness of our claims using more conventional measures of innovation, estimating each of our models against a dependent variable that measures the total number of distinct innovations reported by each department in the previous year (e.g., Damanpour, 1987; Delbecq & Mills, 1985).

Slack. It is difficult to measure slack directly because slack can be deployed at any time in a variety of ways. Most efforts have focused on determining conditions under which slack resources are likely to be available to an organization, using antecedents of slack as an indicator (e.g., Marino & Lange, 1982), for example, or relying upon standard financial data reported for a firm as a whole (e.g., Bourgeois, 1981; Bromiley, 1991; Davis & Stout, 1992; Lant, 1985; Majumdar & Venkatarman, 1993; Singh, 1986; Zajac et al., 1991). The only guidance for measuring slack at the subunit level comes from Bourgeois (1981: 31), who suggested that researchers try and ask organizational members such questions as "Suppose your organization were facing an economic crisis. By what percentage would you be willing to allow your salary (or wage) to be reduced before you would actively search for a position elsewhere?" and "How many perquisites . . . would you be willing to give up?" Lant (1985), who noted that slack may be most salient when it is taken away through interventions like tighter budgets, also suggested the value of such an approach. Bourgeois's approach also coincides with Leibenstein's (1966) notion of X-inefficiency, which he defined as the degree to which actual output is less than maximum output for a given level of inputs.

Following these recommendations, and building upon case research by Schiff and Lewin (1970) that showed that most budgets have some slack because managers routinely overestimate costs and underestimate revenues, we measured the degree of slack within each department by asking the departmental managers the following two questions: (1) "Assume that due to some sudden development, 10% of the time of all people working in your department has to be spent on work totally unconnected with the tasks and responsibilities of your department. How seriously will your output be affected over the next year?" (2) "Assume that due to a similar development, your department's annual operating budget is reduced by 10%. How significantly will your work be affected over the next year?" In both cases, managers were given five choices ranging from 1, "output will not be affected," to 5, "output will fall by 20% or more." The midpoint, 3, could be chosen to indicate that output would fall by about 10 percent, the same as the proposed reduction in resources. We then gave each choice the value of the reported loss in output. Across this range of responses, the higher the reported loss in output, the lower the slack. Thus, we reverse-coded these values for the actual analysis to create our measure of slack. Using these transformations, we created a slack measure corresponding to each question. Because the two measures were highly correlated, we added the two responses, constructing a composite measure of slack ($\alpha = .79$). In the final models, both linear and quadratic terms were introduced for this variable.

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[4] This operational definition also gets around a thorny issue that could be raised by critics of slack. By focusing on the tangible economic benefits derived from the innovations introduced by a subsidiary, we bypassed the problem of measuring the intensity of innovative effort or the number of new projects being included whether or not they created any real value. Our measure still suffers, though, from not capturing the relative returns to investment in innovative projects, because some departments may simply have invested more than others.

It is important to flag one problem with our approach to measuring slack. As Bourgeois (1981: 32) pointed out, there is some question as to whether individuals can accurately assess how much they would be affected by a sudden change and, even if they can do so, they may not be enthusiastic about making such a revelation. We believe that this is not a critical issue here. First, all our respondents were assured that their responses would be treated with the strictest confidence and would in no way be revealed to their senior managements. Additionally, we separated the questions about slack from those on innovation in the survey to avoid any hint that we were looking for a relationship between slack and performance and to prevent hypothesis guessing (Cook & Campbell, 1979). We have reason to believe that our promise of confidentiality worked because our responses were well distributed over the range of possible choices.

Controls

To reasonably assess the relationship between innovation and slack, it was essential to include as controls other variables known or expected to affect innovation. We tried to be as exhaustive as possible and included controls at various levels of analysis.

Environmental forces. A substantial literature addresses the environmental conditions that stimulate innovation (see Kamien and Schwartz [1982] for an exhaustive review). Implicit in most of these accounts is the notion that environmental conditions influence degree of organizational experimentation. Two of the most prominent variables in this literature are the degree of competition faced by an organization (cf. Majumdar & Venkataraman, 1993; Zajac et al., 1991) and the technological dynamism of the environment in which a firm is embedded (cf. Lawrence & Lorsch, 1967). Since Schumpeter's (1926) classic treatise, competition has been seen as a vital spur to experimentation and innovation. Leibenstein (1976), for instance, argued that competition exerts strong pressures on managers to search for new alternatives superior to current production techniques. Similarly, Kamien and Schwartz (1979) argued that loss of market share and performance erosion in competitive environments induce managers to actively search for new ways to maintain or improve their competitive positions. As for technological dynamism, organizations embedded in dynamic technological environments are in the midst of active networks of information and people flows and recognize the importance of innovation for their success; they are hence also more likely to invest in innovative experiments (Burns & Stalker, 1961; Lawrence & Lorsch, 1967).

In each MNC, three senior headquarters managers responsible for the overall global consumer electronics business were asked to complete a survey that included measures of the degree of competition and technological dynamism confronted by each of the national subsidiaries in this sample. The degree of competition was measured by the question "On a scale of 1 (not much competition) to 5 (extremely intense competition), rate the intensity of competition faced by each of your following national subsidiaries." Similarly, the degree of technological dynamism in the environment was assessed by "On a scale of 1 (very slow) to 5 (very rapid), indicate the rate of technological change confronted by each of your following national subsidiaries in their local markets." There was a high degree of convergence across the three respondents in both firms (Cronbach's alpha was .76 in one firm and .84 in the other). Moreover, the measures of competition and technological intensity were highly correlated ($r = .70$). Accordingly, in our final analysis we measured environment as the sum of the average measures of the degree of competition and technological dynamism reported by our respondents for each subsidiary. Given that environment does not vary across the departments in a subsidiary, each department in a given subsidiary received the same overall subsidiary score.

Degree of control. The strength of an organization's internal control is the second factor that affects innovation. Jensen (1993) demonstrated the importance of strong control systems that ensure that R&D as well as other capital expenditures lead to real value-added innovations, providing compelling evidence that the internal control systems of most large organizations routinely fail to adequately discipline their resource allocation processes. A tight internal control system can increase the amount of discipline exercised over the selection of new projects. Of course, if the controls are too tight and employees have too little discretion, the organization may choke all entrepreneurial initiatives. Thus, we expected the strength of an organization's internal control system to have a positive but curvilinear effect on its innovativeness.

We included a number of measures that indicated the extent of control placed over a department's decisions. The first set of measures indicated the degree to which key decision areas were centralized. Respondents within each functional unit were asked to estimate, on scales of 1 (low) to 5 (high), the influence they enjoyed in making five types of decisions: (1) the modification of an existing product, (2) the modification of a production process, (3) the restructuring of the subsidiary organization involving the creation or abolition of departments, (4) the recruitment and promotion of managers to positions below that of subsidiary general manager, and (5) the career development plans for department managers. These decision situations were adopted from an instrument developed and used by De Bodinat (1975). We used an additive scale ($\alpha = .73$) of these five indicators (reverse-scored) as a measured called centralization.

A second set of measures assessed the degree to which key areas of decision making were subject to formal controls. Each respondent was asked to indicate, on a scale of 1 (definitely true) to 4 (definitely false), the extent to which the following five conditions applied: (1) for most tasks there are well-developed rules and policies, (2) my decisions are closely monitored to ensure that rules and policies are followed, (3) for most situations, there are manuals that define the course of action to be taken, (4) for most jobs, there are written job descriptions, and (5) everyone has a well-defined and specific job to do.[5] These questions are in accord with the measures proposed by Pugh, Hickson, Hinings, and Turner (1968) to measure "the degree of employee behavior that is defined by specialist jobs, routines, procedures, and formal written records." Accordingly, formalization, an additive scale ($\alpha = .80$) of all five indicators (reverse-scored), was used to measure the degree of formal control over decision making.

Company. Since the data we collected were from two different MNCs, one European and the other Japanese, we included a dummy variable, company, to control for company-level effects (1 = European, 0 = Japanese).

Subsidiary resource levels. At a different level, we could expect the subsidiary in which a department was located to affect the variables under study. For instance, departments in resource-rich subsidiaries might be expected to be more innovative than those in resource-poor subsidiaries.[6] We thus included as a control a measure of the relative resource levels of the subsidiary to which a department belonged. This measure, subsidiary resource levels, which we expected to be highly correlated with subsidiary size, was also obtained from the headquarters-level respondents described above.

Function. Since the respondents were from departments in different functional areas, we included three dummy variables, R&D, manufacturing, and marketing, each indicating functional area identity. The default option included all other administrative functional areas, such as finance, legal, and

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[5] Questions are paraphrased.

[6] This expectation contradicts Zajac and coauthors (1991), who found that resource scarcity fostered innovation in their particular context (hospitals).

TABLE 1
Descriptive Statistics and Correlations

Variables	Mean	s.d.	Range	1	2	3	4	5	6	7	8	9	10	11
1. Innovation size	1.83	5.48	0–39.35											
2. Innovation number	3.25	1.67	1–6	.10*										
3. Slack	27.36	10.89	0–60	.10*	.01									
4. Environment	6.54	1.91	3–10	.13*	.09	−.11*								
5. Centralization	11.47	4.10	5–25	−.03	−.05	.17**	−.05							
6. Formalization	14.06	2.71	7–20	−.11*	−.00	−.06	−.23**	.11*						
7. Company	0.31	0.46	0–1	−.02	−.06	.30**	−.11*	.28**	−.14*					
8. Subsidiary resource levels	3.37	1.02	1–5	.10*	.12*	−.03	.77**	−.13*	−.09	−.00				
9. R&D	0.05	0.22	0–1	.07	−.01	−.04	.03	−.09	.02	−.11*	.06			
10. Manufacturing	0.19	0.39	0–1	.02	.09	−.04	−.07	−.09	.10*	−.18**	−.07	−.11*		
11. Marketing	0.21	0.41	0–1	.20**	−.09	−.02	.06	.09	−.09	.10*	−.03	−.11*	−.25**	
12. Individual social capital	3.40	1.83	0–9.05	.08	.11*	.05	.30**	.16**	−.02	.18**	.25**	−.04	−.14**	.14**

* $p < .05$
** $p < .01$

human resources. Given that R&D and manufacturing may have greater responsibility for initiating innovative projects than other functions, we expected those areas to report more innovations than the others.

Individual social capital. We also controlled for individual differences in our study, recognizing that some department managers' characteristics and assets might influence the innovativeness of their departments. Following prior research (e.g., Ibarra, 1993; Kanter, 1983), we expected that the greater an individual's social capital, the more innovative his or her subunit was likely to be. Drawing on prior research (e.g., Edstrom & Galbraith, 1977) on the factors that contribute to the development of social capital in multinational organizations, we constructed a measure of individual social capital, defining it as the sum of the following normalized variables: (1) years at headquarters, which indicated the number of years a respondent had worked full-time at his or her firm's headquarters, (2) experience, which indicated the number of years the respondent had worked in the firm, and (3) connection, which indicated the number of days the respondent had spent in task forces, meetings, and training courses over the past year.

Data Analysis

Table 1 shows the descriptive statistics and correlation matrix for the variables in all periods. The correlation matrix suggests that the collinearity among the variables is low. The exception was, of course, the squared term for slack, which was correlated with the corresponding linear effect of slack.

The degree of innovation was modeled using an ordinary-least-squares (OLS) model available in the statistical package SAS. Since the dependent variable is continuous (the dollar value of innovations) and the data are cross-sectional, such a model appeared adequate. In a second set of analyses (results not reported here), we modeled the number of innovations using an ordinal logit model available in SAS. The results obtained with the ordinal logit were later checked against those from Poisson and negative binomial regression models. No differences in the directionality or significance of results were observed.

RESULTS

Table 2 reports the models explaining innovation. The first column reports the effects of the various firm, subsidiary, function, and individual covariates included as controls. This model served as a baseline from which the analysis proceeded. In model 2, we introduced slack to assess its possible linear effects on innovation. In model 3, we introduced the squared term for slack to assess the possibility of its nonlinear effects on innovation.

Several conclusions are immediately apparent from the baseline model. No significant differences in innovation across the two firms were observed.[7]

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[7] To assess company differences further, we estimated unrestricted models for each company (these results are not reported here for the sake of brevity). The signs of the coefficients

TABLE 2
Results of OLS Regression Analysis[a]

	1		2		3	
Variables	*b*	s.e.	*b*	s.e.	*b*	s.e.
Constant	−0.87	8.07	−1.65	8.10	−2.01	8.05
Slack			0.08*	0.04	0.26*	0.09
Slack squared					−0.00*	0.00
Environment	−0.03	0.34	−0.05	0.34	−0.01	0.34
Centralization	0.27	0.47	0.30	0.47	0.32	0.47
Centralization squared	−0.01	0.02	−0.01	0.02	−0.01	0.02
Formalization	−0.08	1.06	−0.18	1.06	0.25	1.06
Formalization squared	−0.00	0.04	−0.01	0.04	−0.00	0.04
Company	−0.48	0.95	−0.94	0.97	−1.25	0.97
Subsidiary resource levels	0.76	0.62	0.66	0.62	0.74	0.62
R&D	$3.40^{\dagger}$	1.81	$3.45^{\dagger}$	1.81	$3.36^{\dagger}$	1.79
Manufacturing	1.26	1.01	1.21	1.02	0.96	1.02
Marketing	3.65*	1.00	3.68*	1.00	3.57*	0.99
Individual social capital	0.03	0.22	0.01	0.22	0.01	0.22
R^2	0.35		0.43		0.51	

[a] The dollar (U.S.) value of innovations is the dependent variable.

† $p < .10$

* $p < .05$

The results indicate that the environmental context of a subsidiary has no influence on the innovative capacity of the functional units within it. That is, the degree of competition and technological dynamism of the local environment appears not to influence innovation in subunits. Further, the directionality of the coefficients for internal controls is as expected but remains insignificant. The squared terms for centralization and formalization hint at the possibility of a nonlinear relationship between each of these controls and innovation, but the coefficients are inconsistent and insignificant, so no strong conclusions can be drawn. The variable for the resource levels of a subsidiary was positive but insignificant, suggesting that resources at this level do not influence innovation. The positive and significant coefficient of R&D and marketing suggest that the subunits from those functional areas were more innovative than those in the default category. We observed no effects of the degree of social capital possessed by a subunit's manager on the subunit's innovativeness.

From our perspective, the most important results are those in column 3 concerning slack. These results are consistent with the predicted nonmonotonic effects of slack on innovation and are significant. As postulated, slack has a significant, inverse U-shaped effect on innovation. We gathered further

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indicated that the postulated main effects observed in the pooled sample held true in both companies. We tried this procedure with dummy variables for each subsidiary and found no differences in the results. Lastly, we also estimated the models separately for each functional area and again found consistent results.

evidence of the role of slack in explaining innovation by comparing the variance explained by the models. Including slack and its squared term in models 2 and 3 leads to an increase in the R^2 term, suggesting a better-specified model. An F-test on the change in R^2 resulting from the addition of the slack variable suggested that the difference is significant.

We plotted the relationship between slack and innovation using the estimates shown here in column 3 of Table 2. The point of inflexion at which innovation starts to diminish with increasing slack occurs at a slack score ranging from 32 to 34 (on a scale of 0 to 60). This pattern also suggests that the degree of reported innovativeness at this point is four times larger than it is when there is no slack. When slack equals the maximum possible in our survey, the level of innovation is once again a fraction of the maximum reached at intermediate levels and is about the same as when slack is at the minimum.

In order to test the robustness of our claims concerning the effect of slack on innovation, we compared the reported results against those obtained using an alternative measure of innovation: the number of innovations accomplished by a subunit. We observed that the main results for slack remain the same (results are not reported here for the sake of brevity). The robustness of this finding was assessed using ordinal logit, Poisson, and negative binomial regression models. The effects of the environment, the degree of control, and individual-level controls are consistent across the two measures but more significant for measures of number of innovations. It is of interest that the effect of the environmental context on the number of innovations was positive and significant, though its significance disappeared when we added measures for the degree of internal controls. These results confirm our intuition that the amount of experimentation (which is perhaps more closely tied to the number of innovations) increases as organizations confront competition and dynamic environments. However, our findings also coincide with those of Kimberly and Evanisko (1981) and confirm that organizational effects, such as degree of control, dominate environmental effects. Our results on the effects of the degree of internal control on innovation are also consistent with our argument that tighter control disciplines the experimentation that occurs and increases the chances that these experiments translate into careful innovations. These minor but theoretically interesting differences in the effects of some of our variables on different conceptualizations of innovation (i.e., dollar value and number) suggest that a finer-grained exploration of differences along these dimensions may be a fruitful avenue for future research.

DISCUSSION AND CONCLUSION

Our results provide strong support for the hypothesized inverse U-shaped relationship between slack and innovation. Our arguments and results help resolve the debate between those who say that slack encourages innovation and those who suggest that slack may in fact inhibit innovation.

The middle ground we advocate—that slack has an inverse U-shaped effect on innovation—provides a way out of this intractable debate. We propose two underlying mechanisms to explain this relationship. The first is the effect of slack on experimentation, and the second is the effect of slack on the discipline exercised over experiments. Too little slack is inimical to innovation because it discourages any kind of experimentation whose success is uncertain. Equally, too much slack is inimical to innovation because it breeds complacency and a lack of discipline that makes it possible that more bad projects will be pursued than good. Taken together, these arguments suggest that the proper way to think about the relationship between slack and innovation is to view it as having an inverse U-shape. Thus, the right question to ask is not whether slack is uniformly good or bad for innovation, but rather, What amount of slack is optimal?

Answering this question may depend upon a number of factors that we have not explicitly explored here. For instance, one might argue that optimal organizational slack is greater in a growing industry than in a declining industry because there are likely to be more positive-NPV projects in the former than in the latter (Jensen, 1993). Similarly, the optimal amount of slack may be determined by firm- and subunit-level factors, such as a firm's culture and internal control systems and the critical contingencies addressed by a subunit.

Relevant to determining the optimal slack in a given situation are questions regarding the antecedents of slack (Sharfman et al. 1988) and how the amount of slack in an organization can be changed. Although it is well established that good performance increases slack and bad performance decreases it, it is less clear what managers can do proactively to change amounts of slack. An additional future possibility would be to distinguish between absorbed and unabsorbed slack, each of which has been shown to have a different effect on the innovativeness and performance of organizations (Singh, 1986). It is also worth noting that we focused on functional subunits as our unit of analysis because they provided an ideal setting for studying the hypothesized relationships. We would hypothesize that a similar relationship between slack and innovation holds at the organizational level as well.

An additional direction for future research would be a longitudinal study that more fully explores the temporal dynamics of the various relationships we have studied. For instance, a shifting environmental context may alter the influences of contextual variables on innovation. A more dynamic model would incorporate risk-taking behavior into the framework and include important feedback links between innovation, firm performance, risk, and the level of slack in an organization. Prior researchers have emphasized such feedback loops, arguing that slack builds up when performance exceeds aspiration levels and gets consumed when performance falls short of expectations (Bromiley, 1991; Singh, 1986). Such accounts would suggest that slack is not only exogenous, but also endogenous when examined over time.

Even though our data limitations prevented us from exploring some of the aforementioned issues, we think they present some of the most exciting opportunities for future research on the determinants of innovation. To ignore this topic because of either polarized theoretical viewpoints or the challenges associated with the measurement of these constructs would be too much of a loss. We hope that our study has resurrected organizational slack and its effect on innovation as an important research topic and will inspire other researchers to follow suit.

In conclusion, we would like to reiterate that recognizing that slack has an inverse U-shaped effect on innovation is not only theoretically important, but also of great practical significance. In a world in which firms must confront simultaneous demands to be innovative and efficient (Bartlett & Ghoshal, 1989), it can be a challenge to maintain the slack that is necessary to stimulate innovation. As Hamel and Prahalad (1994) have cautioned, during the 1980s firms primarily invested in cost-cutting programs such as lean production, downsizing, and business process reengineering, sometimes at the expense of investing in the future. Underlying these efforts is the view that slack represents a reservoir of wasted resources that a firm needs to fully tap to succeed in a competitive global economy. We hope our results provide further warning against such a shortsighted view. Although there is no doubt room to reduce slack in many organizations, it is important to recognize that going too far can jeopardize a firm's capacity for innovation and renewal.

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ORGANIZATIONAL ECOLOGY: PAST, PRESENT, AND FUTURE DIRECTIONS

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We situate the Special Research Forum on Organizational Ecology in the program of ecological research on organizations. We begin with a broad description of organizational ecology's theoretical and empirical development based on the contents of prior collections of work in the field. We then highlight key issues facing ecological research, outline how the articles in this special research forum are linked by common threads, and discuss their contributions. We close with suggested directions for future research.

When it rains, it pours; this adage is an apt description of developments in organization theory in the late 1970s. The three-year span between 1975 and 1978 saw the introduction of four new, influential perspectives on organizations. In 1975, Oliver Williamson published *Markets and Hierarchies,* which redefined transactions cost analysis. In 1977, John Meyer and Brian Rowan published a foundational article on institutionalized organizations, and Michael Hannan and John Freeman published their seminal article on the population ecology of organizations; both works appeared in the *American Journal of Sociology.* In 1978, Jeffrey Pfeffer and Gerald Salancik published their book on resource dependence theory, *The External Control of Organizations.*

The development of these organizational theories and the interplay between them is far beyond the scope of our introduction to the Special Research Forum on Organizational Ecology. Nonetheless, an understanding of the history of organizational ecology is necessary to appreciate the circumstances and issues leading to this special research forum. To this end, we will first sketch the broad outlines of organizational ecology's theoretical and empirical development since 1977. Thereafter, we highlight key issues in ecological research that have emerged from discussions within and outside of the specialty. We then describe the goals of the forum and common threads connecting the articles and close with suggested directions for future research.

We appreciate the light touch of Angelo DeNisi in shepherding this special research forum to completion.

Rather than describe the development of ecological theory chronologically or topically, we have chosen to situate this special research forum by using prior similar forums as benchmarks of the development of ecological research. As collections of a number of related (and important) pieces of work in a single place, special forums are attempts to influence the development of an area of inquiry as well as to showcase its accomplishments. Special forums can be organized in journals or in edited books. To date, three collections of ecological research have been published.

SPECIAL COLLECTIONS AS A WINDOW ON ORGANIZATIONAL ECOLOGY

The first collection was *Ecological Models of Organizations* (1988), edited by Glenn Carroll. This forum contained the results of ten empirical studies and two theoretical works. What does it tell us about the first decade of ecological theory? First, it highlights the primacy of vital rates (entries and exits). Carroll stated that in the beginning "organizational theorists were ignorant about founding and mortality processes" (1988: 2) and that during the decade preceding 1988, knowledge had increased but researchers were still "a long way from any real understanding" of either phenomenon (1988: 2). Thus one of the primary contributions of the collection was a focus on greater understanding of vital rates. Carroll argued that "the chapters in this book will move us along considerably in that quest. For the most part, they report empirical research on the topics of organizational founding and mortality" (1988: 2).

Organization-level change was, at that time, beyond the frontier of ecological theory. In his discussion of adaptation and selection, Carroll pointed out that "organizational ecology is the one new theoretical perspective that does not subscribe to the adaptation model of organizational change . . . adaptive change is not impossible, or even rare, but it is severely constrained" (1988: 2). As a consequence, from a societal viewpoint "most organizational change is the result of processes of organizational selection and replacement rather than internal transformation and adaptation" (Carroll, 1988: 2). Thus, at the end of the first decade of the burgeoning of organization theory, a clear demarcation is made between ecological theory and adaptationist theories, such as resource dependence and strategic management.

The line distinguishing ecological theory and transactions cost theory was, however, somewhat blurred. Carroll argued that "efficiency and effectiveness may drive some organizational selection processes (such as profit-making firms in competitive industries), they may be totally unrelated to others" (1988: 3). Although transactional (or another) efficiency may, in some situations, be consistent with ecological thinking, only "a vulgar interpretation of the ecological selection model holds that efficiency and effectiveness are the only criteria that might account for why one population of organizations replaces another" (Carroll, 1988: 3).

The demarcation between ecological theory and institutional theory had, at least from the ecological perspective, largely disappeared. Thus, as Carroll noted, instead of efficiency and effectiveness, "Political, social, cultural, and institutional criteria can account for many selection processes among organizations. In what may be the most convincing demonstration of this point to date, the chapters that follow pursue these types of sociological arguments with great force and attention to detail" (1988: 3–4).

A second noteworthy feature of the first collection is its methodological consistence. During the decade preceding publication of *Ecological Models of Organizations,* it was recognized that ecological theorizing required longitudinal data and models for dynamic analysis. There was a convergence on a particular technique—hazard function or rate models. Although a few of the empirical studies in the collection used time series models of the type found elsewhere, the majority utilized rate analyses. In fact, there was early convergence on a particular software package, the RATE program developed by Nancy Tuma at Stanford University (Tuma, 1980).

The second collection was *Organizational Evolution: New Directions* (1990), edited by Jitendra Singh. Although the two collections were published only two years apart, the differences are substantial. One important difference surfaced by the second paragraph of the later book. Whereas Carroll posited a focus on vital rates rather than organizational change as a distinguishing characteristic, Singh defined the central thrust of organizational ecology as "the investigation of how social environments shape rates of creation and death of organizational forms, rates of organizational founding and mortality, and rates of change in organizational forms" (1990: 11). The "frontier" of ecology had shifted so that organizational transformation was grist for the ecological mill, and three of the empirical studies in this collection involved analyses of organization-level change, including changes in product-market strategy.

However, the title of the book reveals a more substantial difference. Instead of examining how "changes in organizational populations are largely attributable to how environmental conditions influence the demographic processes of entry and exit in populations," the book "emphasizes organizational evolution, a broader theme" (Singh, 1990: 11). The nature of the empirical studies in the collection and the relative proportions of empirical and theoretical work illustrate this shift in focus.

The empirical studies showcased in the collection are still primarily focused on organizational demographics, analyzing differential entry and exit rates. However, compared with the studies in the first forum, these show greater variability in content and method. The variability in content stems from an emphasis on alternatives to established models—these included a refined risk set alternative to the liability-of-newness model and mass dependence as an alternative to the density-dependence model—and from augmentations of established models (such as the addition of technological and market dynamics to population dynamics). The variability of method is seen in the use of simulation techniques and the reintroduction of conventional methods like tabular analyses and goodness-of-fit tests.

A more visible shift in focus can be seen in the increased proportion of theoretical work to empirical work; not including commentaries, close to half the chapters in this second collection are theoretical. With the benefit of hindsight, we believe that the increased emphasis on theoretical development was a necessary consequence of the shift from a purely ecological perspective to an emphasis on evolution. This shift can be seen in the nature of the theoretical pieces, which concern speciation, strategy making, community ecological, and evolutionary economics. At the time of the second special forum, few of the established models in organizational ecology provided a theoretical base for these new directions.

The shift to evolution from ecology was greatly facilitated by a shift in participants. On the surface, there was a substantial overlap of authors between the Carroll and Sinah volumes: of the 22 authors in the second collection, 10 had contributed to the first collection. However, a number of writers in the second book were not established ecologists. Economists, scholars from strategic management, and even a physicist contributed, whereas the majority of authors in the earlier volume were sociologists, many of them students of Michael Hannan or John Freeman.

The boundary between organizational ecology and institutional theory had shrunk by the time of the first special collection. By the time of the second, many of the boundaries separating ecology and other areas of organization studies had faded as well. The relationship between adaptation and selection had been incorporated as an important theoretical issue. This produced a potential overlap of ecology with not only transactions cost theory and resource dependence theory, but also with strategic management.

The third special collection was *Evolutionary Dynamics of Organizations* (1994), edited by Joel Baum and Jitendra Singh. Baum and Singh pointed out that "the principal focus of this volume is the hierarchical nature of organizational evolution . . . . Accordingly, the four main sections of the book address *intraorganizational, organization, population,* and *community* evolution" (1994c: vii). The second collection introduced a shift from ecology to evolution, but the third collection elaborated evolutionary thinking and began a serious attempt to integrate processes at different levels of analysis.

The first shift in focus involved an increase in theory over empiricism. The elaboration of evolutionary work also meant giving attention to theoretical issues, particularly in the newest areas of research. Sections three (organization) and four (population) of *Evolutionary Dynamics* were predominantly empirical, with seven of nine chapters devoted to empirical analyses of one kind or another. These sections were devoted to core areas with very well developed models and problems. Section five (community) contained five chapters, three of which were theoretical. Community-level evolution had received some attention in both of the prior special collections (and in the wider stream of research). The newest addition to evolutionary theory was intraorganizational evolution. This section contained three chapters: two were theoretical, and the other was a simulation.

The contributors to this 1994 special collection were both more numerous and more diverse than the first two collections' contributors. More than two-thirds of the 1994 contributors had worked in areas other than organizational ecology, including evolutionary economics, strategic management, institutional theory, and the management of technology and innovation. The extension of the frontiers of organizational ecology was clearly accompanied by a broadening of the affiliations of the people involved.

What does our examination of earlier special forums suggest? Organizational ecology was initiated at the same time as three other influential theories of organizations, and the early emphasis was on differentiating ecological theory not only from its predecessors but also from its competitors. As Carroll pointed out in the first special collection discussed here, "Organizational ecology is the one new theory that does not subscribe to the adaptation model of organizational change" (1988: 2). A focus on vital rates was the distinguishing feature of ecology, and most efforts were devoted to theoretical models of vital rates and the empirical testing of these models. Longitudinal analysis of vital rates produced methodological demands (techniques for analyzing rates of events over time) on ecology unlike the demands faced by the competing theories, and ecology was soon distinctive methodologically as well as substantively. This combination of distinctive theory and method led Carroll to argue that, compared to the other three theories, organizational ecology showed the greatest generality and that "advocates of the other theories would do well to take heed" (1988: 6).

However, by the time of the first collection, there were also considerable differences of opinion and emphasis within ecology, revolving primarily around institutional theory and levels of analysis (Carroll, 1988: 6). Ecological theory had incorporated portions of institutional theory, albeit only as determinants of vital rates. This produced differences of opinion about the relative roles of competition and institutional constraints as determinants of vital rates. There was also divergence about how much emphasis to place on the community and, to a lesser extent, organizational levels of analysis.

Domain defense soon turned into domain expansion. Although the research program of organizational ecology had been successful, other theories had also generated bodies of work demonstrating their efficacy. The main barrier to expansion was the exclusion of organization-level transformation as a significant source of change in the composition of organizational populations. This barrier could be removed by a theoretical elaboration: the theorem excluding adaptation is replaced by hypotheses on the *relationship* between adaptation and selection. These hypotheses require greater attention to theoretical development (which occurred in the second collection) and, we would argue, substantive interaction with scholars from other domains, which also occurred.

A second change was the increasing attention paid to community ecology. The barrier to expansion in this domain was less theoretical than empirical. An appreciation for community dynamics had long existed in organizational ecology, and some theoretical models were available as foundations for empirical analyses. However, the data requirements were imposing. It is difficult enough to gather comprehensive longitudinal data on a single population of organizations. The task of collecting such information on multiple, interacting populations is intimidating. It is not surprising that most work has been (and continues to be) theoretical.

The most recent collection shows the beginnings of a division of labor. The broad focus is on evolutionary change across multiple levels of analysis, with much attention given to integrating processes at different levels. Each level continues to develop on its own, with researchers' paying attention to core problems. Thus, population ecology continues to develop and test models of vital rates, but not in isolation from the organization and community levels.

KEY ISSUES IN ORGANIZATIONAL ECOLOGY

The impressive volume of research conducted and published since Hannan and Freeman's (1977) foundational piece on population ecology has been accompanied by critiques of ecological research by sociologists outside the specialty of organizational ecology and reflective discussions of gaps in the field by organizational ecologists.

Early criticisms of ecology centered around its neglect of powerful organizations (Perrow, 1986), but those criticisms have become obsolete as ecologists have modeled the fates of powerful organizations by analyzing size dependence in death rates (Carroll, 1984; Wholey, Christianson, & Sanchez, 1992), dominance in technological systems (Barnett, 1990), and size-based segmentation of populations (Amburgey, Dacin, & Kelley, 1994). Young (1988) assailed organizational ecologists for using unclear definitions, weak measurement, and a narrow focus on competition and concluded that population ecology was not a useful paradigm. However, as Brittain and Wholey (1989) noted, ecological research has not only benefited from systematic replications in diverse populations, but also from broadened models of competition. Pfeffer (1993: 613) opined that, of the various specialties in organization studies, population ecology has the highest degree of consensus; he pointed to the consistency in methods dependent variables, works cited, and valuation of problems across studies.

More recently, neoinstitutional theorists and organizational ecologists have joined together in critical assessments of the program of research on density dependence in organizational populations. At the same time, ecological researchers have also reflected on gaps in the study of organizational foundings, mortality, adaptation and selection processes, and the problems posed by diversified organizations. Below, we outline each of these issues to set the stage for delineating the contributions made by the articles in this special research forum.

Density Dependence

Much like the Phillips curve showing the inflation-unemployment trade-off in macroeconomics, density-dependent models of founding rates and death rates have inspired considerable debate. Drawing on neoinstitutional models according to which sheer prevalence makes social arrangements taken-for-granted, Hannan (1986) originally proposed that legitimation and competition underlie a U-shaped relationship between population density (the number of organizations) and the failure rate of organizations and an inverted U-shaped relationship between population density and the founding rate of organizations. Studies of several industries have supported the predicted relationships between population density and failure and founding rates (Hannan & Carroll, 1989; see Hannan & Carroll [1992] for a detailed review).

Neoinstitutionalists such as Zucker (1989) have questioned whether density is a credible proxy for cognitive legitimacy and urged the use of more proximal surrogates. Barnett and Amburgey (1990) pointed out that density dependence presumes that all organizations have an equal impact and urged the use of mass dependence to account for the impact of larger organizations. Peterson and Koput (1991) simulated density dependence in death rates and suggested that it is an artifact of unobserved heterogeneity. Delacroix and Rao (1994) noted that empirical support for density dependence in death rates was weaker than the support for density dependence in founding rates, and they urged that density effects be unbundled because they mix the impacts of track record, vicarious learning, and the development of an infrastructure.

Building on the idea that the ability to make use of institutional infrastructures influences mortality, Baum and Oliver (1992) reported that that relational density—the number of formal relations between the members of a population and key actors in the population's environment—diminished death rates and increased founding rates. In related analyses, Baum and Singh (1994a, 1994b) differentiated between overlap density and nonoverlap density to measure potential competition and potential mutualism. They reported that overlap density dampened foundings and increased death rates, whereas nonoverlap density increased foundings and diminished death rates. More recently, Baum and Powell (1995) suggested that if an institutional ecology of organizations is to be cultivated, ecologists need to use non-density-based alternatives to incorporate the effect of sociopolitical legitimacy.

These critical assessments have also inspired rebuttals in defense of density-dependence theory. Carroll and Hannan (1989) defended density as a proxy for the prevalence of an organizational form because it had the advantage of generalizability. In a rejoinder to Peterson and Koput (1991), Hannan, Barron, and Carroll (1991) simulated density dependence in death rates and reported that under controls for age dependence, unobserved heterogeneity produced spurious density dependence in three out of ten simulations. In a reply to Baum and Powell, Hannan and Carroll (1995) proposed that sociopolitical legitimacy may not be an exogenous variable but can be a consequence of population processes, and they defended density-based approaches to legitimation as providing a general and parsimonious account of vital rates.

The debate about density dependence has directed attention to the measurement of legitimacy; however, one issue that has received less attention is the distinction between the legitimacy of a form and the legitimacy of individual organizations. The density-dependence thesis makes cognitive legitimacy a collective good that is freely accessible to all organizations within an industry rather than an organization-specific endowment in the form of reputation that is inaccessible to rivals. Rao (1994) showed that victories in road races enhanced the survival of automobile producers after controlling for density and interpreted this effect to mean that victorious organizations enjoyed a higher status and were able to benefit exclusively from the Mathew effect (that is, they were rewarded disproportionately because of higher status). However, this study spanned only the early history of the automobile industry, from 1885 to 1912, and it could not test the density-dependence thesis, which requires data on a form over its complete life history.

One useful way to extend ecological research on density dependence is to simultaneously assess the effects of form-level legitimacy stemming from density and organization-level reputation. Do low-status organizations with poor reputations die at a faster rate than high-status organizations, even if they are protected by form-level legitimacy? Does the reputation of high-status incumbents deter foundings even when form legitimacy is on the rise? Alternatively, does the reputation of individual organizations generate spillover effects that are beneficial to all instances of a form? Research on these and other related issues is sorely needed to illuminate the boundary conditions of density dependence.

Organizational Foundings

The proliferation of ecological analyses of foundings (see Aldrich and Wiedenmayer [1993] for a review) has also occasioned reflective discussions of gaps by ecologists. One limitation of ecological research on foundings is that it understates organizational diversity because it includes only the outcomes of successful founding attempts and overlooks unsuccessful founding attempts (Delacroix & Carroll, 1983). Owing to the dearth of data on preorganizing processes, organizational ecologists rarely distinguish successful events from nonevents in the founding process. Instead, ecological researchers concentrate their attention on the times between the appearance of operational start-ups—that is, successful new entities that begin to produce goods and services. A sample selection bias ensues because many emerging organizations fail before they start operations: some potential founders fail to incorporate, and newly incorporated entities may be unable to commence production (Aldrich, Rosen, & Woodward, 1986; Hannan & Carroll, 1992). Hence, organizational diversity is understated because selection processes winnow out emerging organizations and lead to the retention of a few operational start-ups. Moreover, selection pressures may be more intense for emerging organizations than for operational start-ups because emerging organizations may lack formal goals, clear boundaries, and unambiguous technologies.

Ecological researchers seldom differentiate the subprocesses of announcement, incorporation, and operational start-up or analyze differences in their causal structure (Hannan & Freeman, 1989: 148). Consequently, they model the arrival of operational start-ups (successful foundings) as an event recurrence process and represent it as a point process; a timed counter of events with the set of integers representing the state space of the process. Since each value of the counter of events is a state, the overall rate of the occurrence of the event is the object of study, and time dependence between events is treated as a nuisance function.

However, the founding process can also usefully be described as a state transition process. Unlike an event recurrence process, a state transition process has a small state space; as a result, each state is substantively interesting, and transitions between states become the objects of study. For example, potential organization builders with prototypes can incorporate and then start operations; alternatively, they can start operations and then incorporate. Incorporation entails the establishment of a corporate actor and increases the ability of entrepreneurs to act as one body despite fluid membership. Operational start-up means that a new organization has commenced the production of goods and delivery of services to its customers and therefore implies that a founding attempt has come to fruition. A few studies have usefully analyzed the transition from incorporation to operational start-up (Roberts & Hauptman, 1987; Schoonhoven, Eisenhardt, & Lyman, 1990), but incorporation can also succeed operational start-up in a given industry.

Because of the dearth of research on the subprocesses of incorporation and operational start-up in single organizational forms, researchers know little about the antecedents of successful organizing attempts. We do not know much about the relationship between the duration of the gestation or preorganization phase and the rates of incorporation and operational start-up. Moreover, we also do not know if delayed incorporation dampens operational start-up rates. Similarly, there is little evidence on whether delayed operational start-up diminishes incorporation rates. Furthermore, we do know how lateral entries by established organizations influence the speed of incorporation and operational start-up. Research on the structure of the founding process can also direct attention to the impacts of prior start-up experience, prior social ties among founders, and the social capital of founders on the pace and success of organizational-building efforts (Eisenhardt & Schoonhoven, 1990).

Including potential organization builders, incorporations, and operational start-ups as actors in the drama of founding can shed light on the microfoundations of ecological research and address the following questions: Is the macrolevel model of density-dependent legitimation and competition compatible with a rational actor model of entrepreneurs? Do macrolevel processes of legitimation and competition affect entrepreneurial beliefs about the viability of ventures? Is the density-dependent selection of emerging organizations a special instance of how environmental feedback shapes the actions of decision makers? The detailed study of these issues is essential to expand knowledge of organizational diversity and shift attention from entrepreneurs to the organization-building process as an object of sociological inquiry.

Organizational Mortality

Despite numerous ecological analyses of organizational death relying on diverse populations (see Baum [1995] for a review), researchers' understanding of dissolution, be it through merger, absorption, or outright failure, is limited by the dearth of studies that treat financial performance as a predictor of mortality. Do poorly performing organizations tend to persist, as Meyer and Zucker (1989) argued, or do they fail faster than others, or do their desperate tactics precipitate the failure of proximal organizations? Some writers have suggested that poor performance excites a spiral of high risk taking and poor performance and noted that unpredictability of a firm's income stream jeopardizes the explicit and implicit commitments of an organization to its stakeholders (Bowman, 1984; Bromiley, 1991). Therefore, an issue deserving attention is whether risk jeopardizes survival and how it interacts with performance and constrains the life chances of organizations.

Ecological research on mortality has tended to overlook how existing organizations are relationally embedded in social networks; exceptions include the studies by Miner, Amburgey, and Stearns (1990) and Baum and Oliver (1991) on the impact of interfirm links on death rates. Board interlocks knit top managers of companies into an intercorporate network (Pfeffer & Salancik, 1978), and firms can be connected to each other through strategic alliances and joint ventures. A testable proposition meriting scrutiny is whether centrality in a network enhances autonomy and confers survival advantages to organizations (Pfeffer, 1987). However, structural embeddedness, as Granovetter (1985) noted, need not always promote social order; it can also generate disorder. Therefore, social ties can also serve as conduits for the transmission of hostile influences and hasten death.

In a related vein, the death of network organizations is also a topic that has received scant attention in ecological research. Organizations may belong to a corporate network, such as a Japanese *keiretsu,* or be controlled by one business family, as in a South Korean *chaebol* or a Taiwanese *jituanqiye.* Unlike individual organizations that fail by liquidation or absorption, enterprise groups cease to exist when the links between the central unit and constituent organizations are severed. The linchpin organization may be forcibly closed, reorganized, or dissolved, and the constituent organizations may drift apart to join other groups or form new networks. Comparative ecologies of the decline of different enterprise groups could help to delineate the boundary conditions of the mortality of network organizations. For instance, one could compare the failure of the Kaiser group in the United States with that of the Suzuki family of organizations in Japan. A related issue of interest concerns the fates of constituent organizations after the collapse of the central organization in a business network. Constituent organizations may cohere to form new groups, be attached to other enterprise groups through force or consent, or cease to exist. At least two questions emerge: When are such organizations likely to be attached to other groups? When are they likely to form a new network organization? Research on these issues can extend our knowledge of organizational birth trajectories and affiliative dynamics.

Adaptation and Selection

A central issue in organization theory concerns whether organizational change consists of organizations' adapting to their environments (Lawrence & Lorsch, 1967; Thompson, 1967) or whether instead organizations are inert and unable to undertake reorganizations of goals, authority, technology, and market segments (Hannan & Freeman, 1984). Ecological research on organizational change has analyzed the effect of interorganizational links on the rates and effects of change (Baum & Oliver, 1991; Miner et al., 1990). Studies have also assessed the dynamics of the propensity to change and the dynamic effects of change on the survival prospects of organizations (Amburgey, Kelly, & Barnett, 1993). Extant studies contrasting adaptation and selection have tended to neglect the sources and effects of changes in goals, authority, and technology on the life chances of organizations and their financial performance (Barnett & Carroll, 1995). Moreover, although a commonplace proposition in organization theory is that organizations learn from experience, there is also a dearth of research on how organization- and population-level learning processes facilitate adaptation and diminish mortality.

If organization-level analyses routinely treat change and death as competing risks for individual organizations, the rise of network organizational forms makes it necessary for ecologists to model change and foundings as competing risks. As microcommunities, network organizations can be viewed as incubators for creating new organizations and adapting existing subunits. Hawley (1986) suggested that functional differentiation in communities can come about by changes in existing units or the addition of new units. Hence, mutual fund families can either change the objectives of existing individual funds or create new funds. Similarly, a business unit of a Japanese *keiretsu* or a South Korean *chaebol* can diversity into an area; or alternatively, a new business unit can be established to secure a beachhead in a new marketplace. In such cases, adaptation and foundings become competing risks for the network organizational form. It is also possible that an existing unit can enter a new niche and the entry can be spun off into a separate entity; thereby, adaptation can precede spin-off.

Because of their focus on organization-level events, organizational ecologists have not devoted much attention to whether industry evolution operates through replacement of one unchanging organizational form by another or through mutation of the members of one organizational form into another (Haveman, 1995a; Haveman & Rao, 1996). Prior researchers have examined the founding, transformation, and failure of individual organizations without determining the impact of these processes for entire industries. Studies that examine how microlevel events (foundings, transformations, and failures) cumulate into a macrolevel process (the replacement of one form of organization by another) are essential to determine how change in industries comes about. Such analyses are also essential to fulfilling the broadest goals of organizational ecology research—understanding "how social conditions affect the rates at which new organizations and new organizational forms arise, the rates at which organizations change forms, and the rates at which organizations and forms die out" (Hannan & Freeman, 1989: 7).

The Diversified Organization

The emergence of large, diversified firms is a well-established change in the world of organizations that presents a substantial challenge to organizational ecology. As Hannan and Freeman (1988: 9) pointed out, the crucial element in population ecology is the population of organizations, and the first assumption is that organizational populations can be defined so that they have a unitary character: the members must have a common standing with respect to the processes of interest. One way to express this problem is to ask the question, To what organizational population does the General Electric corporation belong?

One technique for addressing diversified organizations is to examine mixtures of freestanding organizations and subunits of diversified organizations. Although such examinations can certainly reveal interesting phenomena, they are not without problems. On the face of it, such an analysis is the organizational equivalent of defining all organisms that eat grass as belonging to the same population. If, in fact, subunits of diversified organizations and freestanding organizations do not have common standing with respect to the processes of interest (creation, dissolution, and transformation), then this practice does not withstand the first assumption of the theory. Unfortunately, there are theoretical and empirical reasons to believe that subunits and organizations do not have common standing (Freeman, 1990).

The question of common standing aside, this approach involves a version of methodological individualism; in effect, its assumption is that the diversified organization is a congeries of essentially independent elements. Thus, all relevant information can be obtained through matching subunits with freestanding populations. Although this may be an accurate representation for some diversified organizations (e.g., conglomerates based on unrelated diversification), it ignores the interrelated value chains and economies of scope used by others.

If a piecewise inclusion of diversified organizations into ecological analysis is problematic, what about defining a population that consists of diversified organizations? This approach is also not without problems. On the face of it, it is the organizational equivalent of defining all omnivores as belonging to the same population. What level of diversification constitutes a birth into this population? Do organizations of equal diversity but unequal size or scale have common standing with regard to vital processes?

Organizational ecology has produced significant advances through the analysis of populations of organizations that can be easily differentiated from others and in which common standing with regard to vital processes can be demonstrated. It can be legitimately argued that this approach is very broadly applicable; there are undoubtedly more independent restaurants than there are *Fortune* 500 firms. Nonetheless, large, diversified firms are an important part of the world of organizations. A way to incorporate them into the domain of organizational ecology would be a major advance.

ARTICLES IN THE SPECIAL RESEARCH FORUM

The preceding issues motivated us to organize the Special Research Forum on Organizational Ecology to extend ecological research on the vital rates of organizations—foundings, mortality, and adaptation—and to strengthen bridges between ecological theory, neoinstitutional theory, strategic management, organizational economics, agency theory, and entrepreneurship.

As noted, Pfeffer (1993: 613) wrote that, of the various specialties in organization studies, population ecology had the most consensus. We agree with Pfeffer's characterization of organizational ecology and with his argument about the importance of consensus in the development of cumulative knowledge. However, consensus and consistency should be dynamic; new concepts and techniques that arise need to be incorporated to the extent that they address central issues. This presents a conundrum: How can organizational ecology maintain the *dynamic* consensus necessary for the cumulation of knowledge? We want population ecology to be an area in which "those who study organizations energetically seek out ideas, perspectives, and techniques," but we do not want a situation in which "fundamentally any theoretical perspective or methodological approach is as valid as any other" (Pfeffer, 1993: 615).

Our view was that a focus on *central problems* was crucial; if a phenomenon is defined by the ecological literature as significant (births, changes, and deaths within organizations, populations, and communities are examples), and new concepts and techniques can be fruitfully incorporated from other theoretical perspectives while consensus is maintained. In the call for papers, we tried to outline some areas of overlap between ecological theory and other perspectives, such as neoinstitutional theory, strategic management, organizational economics, agency theory, and entrepreneurship. We also took Pfeffer's comments on how social structure maintains consensus to heart; the reviewers for the special forum represented a variety of different theoretical perspectives, although ecological scholars were the most numerous.

We believe that the articles presented here extend the frontiers of organizational ecology both theoretically and methodologically. Below, we briefly describe some commonalities among the articles and highlight the importance of the extensions provided by each. We close with some suggestions for future research.

Four of the five works concern organizational foundings (Bruderer & Singh, Baum & Oliver, Usher & Evans, and Lomi & Larsen) and establish new links between organizational ecology and the field of entrepreneurship. Similarly, four articles analyze organizational mortality (Bruderer & Singh, Usher & Evans, Lomi & Larsen, and Swaminathan) and enlarge the contact between ecological theory and neoinstitutional theory and strategic management. Three (Bruderer & Singh, Usher & Evans, and to a lesser extent, Swaminathan) examine the relative roles of adaptation and selection in evolutionary change and extend understanding of the relationship between transformation and selection processes. As this inquiry proceeds, the overlap between ecological theory and other perspectives, such as neoinstitutional theories, strategic management, and institutional economics, becomes substantial. Three of the five articles (Baum & Oliver, Lomi & Larsen, and Usher & Evans) involve shifts in levels of analysis or geographic aggregation, shifts away from a unitary conception of organizational populations and niches and toward a more detailed treatment of intrapopulation heterogeneity and the "local" environments of organizations. Ecological theorizing has often incorporated organizational heterogeneity within a population (i.e., distinctions between specialist and generalist forms, or the varying age of organizations). Environmental heterogeneity, in the sense of different local environments rather than a single common environment, occurs much less frequently in ecological models than organizational heterogeneity. As ecological theorizing encompasses local environments and the microstructure of organizational niches, the interplay between strategic management and organizational ecology will increase in importance.

Three articles (Bruderer & Singh, Lomi & Larsen, and Usher & Evans) depart from the research designs and analytic techniques commonly used in ecological research. Simulation techniques offer analytic leverage when empirical data of the type necessary to examine a particular problem are not available. Few areas of organization studies are as empirically demanding as organizational ecology. Simulations, particularly when they are linked to other empirical work, offer a new set of tools to ecological researchers.The study by Usher and Evans is not a simulation, nor is it a large-scale event-history analysis—it is a descriptive historical account of organizational evolution. As such, it illustrates the process of organizational evolution in a very accessible fashion. Finally, two of the articles (Baum & Oliver and Swaminathan) are comparative analyses of distinct populations; the former analyzes for-profit and nonprofit sectors whereas the latter compares Argentine newspapers and American breweries.

Although the articles in this forum share some commonalties, each makes its own unique contribution. Bruderer and Singh's work, "Organizational Evolution, Learning, and Selection: A Genetic-Algorithm-Based Model," takes research on the relationship between adaptation and selection in a completely new direction. As noted earlier, much of the work on adaptation concerns the effect of changes on organizations but says little about the impact of organizational learning. Bruderer and Singh demonstrate that the differing ability to learn new routines changes the selection regime (in their case, from a fitness landscape without intermediate levels of fitness to one that has intermediate levels of fitness). In a related vein, "Environmental Conditions at Founding and Organizational Mortality: A Trial-by-Fire Model," by Swaminathan, suggests that failures of organizations under high adversity may facilitate collective learning of a vicarious sort and enable survivors to develop successful recipes. He tested whether adverse environmental conditions at the time of founding burden organizations with an initial or permanent liability or whether a "trial by fire" reduces mortality by enabling survivors to learn from the experience of failures. Analyses of American breweries and Argentine newspapers show that with increasing age, organizations founded under high adversity experience a lower death rate than those founded under low adversity and thereby provide support for the trial-by-fire hypothesis. The article by Usher and Evans, "Life and Death along Gasoline Alley: Darwinian and Lamarckian Processes in a Differentiating Population," contributes not only in substance and technique, but also in exposition. The substantive contribution lies in the analysis of adaptation and selection processes within a population (the same problem addressed by Bruderer and Singh). However, in some respects, the more important contribution is in technique and exposition. Usher and Evans provide a qualitative, descriptive account of organizational evolution rather than the quantitative event-history analysis that typifies empirical work in organizational ecology. In our opinion, this divergence makes the substance of their research much more accessible to organizational scholars who are not specialists in organizational ecology.

Lomi and Larsen's work, "Interacting Locally and Evolving Globally: A

Computational Approach to the Dynamics of Organizational Populations," examines the relationship between local, microlevel processes and aggregate, population-level outcomes. As noted earlier, despite the substantial support in favor of the density-dependence model of population dynamics, little is known about its microfoundations. A number of scholars have noted that organizational populations (and environments) are heterogeneous and have asked the question posed by Lomi and Larsen: How can the behavior of individual organizations responding to their local environments give rise to the consistent aggregate pattern so widely observed? The simulation presented here not only indicates how fairly simple rules for local behavior can produce the aggregate outcomes frequently observed in empirical studies, but also suggests how different microprocesses can produce the differences in aggregate outcomes that have been observed.

Finally, in "Toward an Institutional Ecology of Organizational Founding," Baum and Oliver compare the strength of the effects of ecological and institutional characteristics of niches on the founding rates of day care centers. As noted earlier, one limitation of ecological research is that organizations' relationships with other organizations have been overlooked. Baum and Oliver develop the construct of nonoverlap intensity (the degree of resource nonoverlap among potential competitors) to describe the potential for cooperation among competitive organizations. They show how the effects of nonoverlap intensity, relational density, overlap, and nonoverlap density vary within and between nonprofit and for-profit organizational sectors as well as across levels of geographic aggregation. These results expand ecological research by illuminating the links between for-profit and nonprofit sectors and the play of ecological and institutional processes across local and wider levels of analysis.

In our view, the articles published in this forum extend the frontiers of organizational ecology by exposing innovative approaches and to a lesser extent, enlarging dialogue between ecological theory and other perspectives on organizations. We also believe that much work remains to be done to advance the dialogue between ecological theory and other specialties in organization theory.

FUTURE DIRECTIONS

Organizational economics is one area of overlap that remains to be explored. According to transactions cost economics and agency theory, selection processes shape the survival of organizational forms. However, both perspectives emphasize efficient monitoring and incentives as central to the survival of organizations (Fama & Jensen, 1983; Williamson, 1975). By contrast, ecological theorists hold that although efficiency issues affect organizational change, institutional processes such as legitimacy constrain their impact (Hannan & Carroll, 1992). In one study, Rao and Neilsen (1992) found that stock savings and loan associations outlived mutual savings and loan associations because of the former's superior monitoring, but they also reported that deregulation eroded the advantage enjoyed by stocks. Additional studies of how population-level change is jointly shaped by efficiency considerations and institutional processes are sorely needed to enrich the dialogue among those positing economic, ecological, and institutional models of organizations.

The growth of network organizational forms that are between markets and hierarchies holds rich opportunities to shed light on the degree to which complementary assets, coordination problems, and legitimacy shortages underlie the rise and fall of intermediate organizational forms. One type of network is the Japanese *keiretsu,* the South Korean *chaebol,* and the Taiwanese *jituanqiye.* Another consists of organizational networks created through strategic alliances, joint ventures, and other forms of relational linkages (the blending of competition and cooperation into "coopetition").

Profitable opportunities exist for an interchange between organizational ecologists and students of issue evolution. Models of issue evolution that emphasize scarcity of public attention, issue competition, and the trajectories of issue development (Hilgartner & Bosk, 1988) also implicate organizations as significant actors in the drama of issue evolution. In a related vein, albeit with a different vocabulary, social movement theorists have suggested that the relationship between moderate and radical social movement organizations and the interplay between organizations championing a movement and organizations promoting a countermovement influence the fates of issues (McAdam, McCarthy, & Zald, 1988). Ecological models of niche width (Carroll, 1985; Freeman & Hannan, 1983) can be used to model how diffuse competition between moderate and radical movement organizations influences the rates at which they attract new members. Alternatively, diffuse mutualism might exist between radical movement organizations and moderates because of radical flank effects (Haines, 1984) whereby extremists make it easier for moderates to garner funds. Density-dependent models of evolution may shed light on the coevolution of movements and countermovements, and on how organizational dynamics underlie the rise and fall of issues.

Moreover, explicit attention to the coevolution of institutions and organizations can enhance the interchange between ecological and neoinstitutional theories (Scott, 1995). Although there is a growing body of research on the coevolution of technologies and organizations (e.g., Tushman & Rosenkopf, 1992), there has been very little work on the coevolution of institutions and organizations, even though organizations are a primary carrier of institutions. In a study of the California thrift industry from 1865 to 1928, Haveman and Rao (1996) showed that theories about thrift were primarily restructured through the differential birth of new organizations and death of old organizations, and only secondarily through the modification of established organizations. Research on the coevolution of institutions and organizations is needed to shed light on how institutional entrepreneurs deploy organizational forms to disrupt existing arrangements and shape new conventions (Clemens, 1993).

Future studies can also consolidate links between ecological research and study of the professions. Abbott (1990) suggested that interprofessional competition and intraprofessional differentiation play crucial roles in the development of professions. Ecological analyses can demonstrate how density-dependent legitimation and competition can influence professional dominance over a certain market or jurisdiction. Wholey, Christianson, and Sanchez (1993) showed that the formation of health maintenance organizations was shaped by density-dependent relationships between physician and corporate interests. In a related vein, ecological analyses can also delineate how organizational dynamics underlie the decline of professions; for example, the rise of educational technologist degree programs that treat library management as a minor area of study may not only have contributed to the replacement of librarians by educational technologists in budget-constrained schools but also led to the demise of library science schools.

A natural extension of modeling occupational dynamics is to strengthen the growing links between ecological research and the study of careers (Carroll, Haveman, & Swaminathan, 1992). Recent analyses of the effects of population dynamics on personnel mobility in the thrift industry (Haveman & Cohen, 1994) and the impact of industry dynamics on tenure distributions and turnover (Haveman, 1995b) point to the potential for fruitful cross fertilization. Ecological analyses of careers may also shed light on the distribution of gender and age inequalities in labor markets. Density-dependent processes and relational density stemming from the embeddedness of actors in social networks may enlarge our knowledge of how ethnic groups come to dominate an industry.

One final topic worthy of exploration is endogenous population change. March pointed out that one of the most important developments in evolutionary theory is "the emphasis on endogenous environments, on the ways in which the convergence between an evolving unit and its environment is complicated by the fact that the environment is not only changing, but changing partly as part of a process of coevolution" (1994: 43). The coevolution of populations is an important element of community dynamics but one not captured by the dominant modeling approach. Most work in community processes uses the Lotka-Volterra models of population growth and decline to capture the effects of one population on another. Although useful, this approach does not lend itself to analysis of coevolutionary processes that involve more than fluctuations in numbers of organizations.

Technological change is one such process. The technological innovations produced by firms within a population affect other organizations (such as venture capital firms) and the population itself in ways other than increasing or decreasing the size of the population. For example, technological innovation can produce changes in the selection regime so that different forms are favored (without changing net population size). It is likely that institutional coevolution has the same character.

Organizational ecology needs consensus to generate cumulative knowledge, but new concepts and information must be incorporated if ecological theory is to remain vibrant. Among all of the various specialties of organizational theory, ecological theory is the most closely tied to *evolution*. It would be a bitter irony if ecological theorizing were to remain inert as the world of organizations changes.

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INTERACTING LOCALLY AND EVOLVING GLOBALLY: A COMPUTATIONAL APPROACH TO THE DYNAMICS OF ORGANIZATIONAL POPULATIONS

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We present a computational model of organizational evolution according to which the global dynamics of organizational populations emerge from simple rules of local interaction among individual organizations. Under a variety of simulated evolutionary conditions, the model's behavior is in qualitative agreement with empirical observations of actual organizational populations. Estimates on the synthetic data are compared with those obtained by empirical studies of founding processes. The key insight is that the density-dependence theory is consistent with many microprocesses that regulate the birth, survival, and death of individual organizations. However, the population-level relationship between density and organizational vital rates is highly sensitive to the range and rules of local interaction among individual organizations.

When observed over long time spans, the number of organizations in a population initially grows slowly, then rapidly, up to a peak. After this maximum density is reached, the number tends to decline before stabilizing at a lower level of density, which remains more or less stable for a long time. The ecological theory of density dependence provides an analytical framework for understanding the regularities empirically observable in the evolution of organizational populations in a wide range of technical, cultural, and institutional contexts (Baum & Singh, 1994; Carroll & Hannan, 1995; Hannan & Carroll, 1992; Singh, 1990).

According to the theory, this recurrent pattern of growth, stabilization, and decline is the consequence of opposing forces generated by two general process: legitimation and competition. Legitimation refers to the conformity

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of a new venture with established institutional rules and expectations (Aldrich & Fiol, 1994). Competition refers to the constraints that arise from firms' joint dependence on a similar set of limited resources (Carroll & Hannan, 1993: Ch. 3). Organizational vital rates (founding and mortality rates) are systematically related to legitimation and competition, which are, in turn, a function of density. Specifically, in the ecological theory density increases legitimation at a decreasing rate and increases competition at an increasing rate (Hannan, 1992; Hannan & Freeman, 1989).

One problem with this general explanation concerns the level at which the relationship between density and organizational vital rates should be specified (Lomi, 1995a; Singh, 1993). For example, populations of restaurants, newspapers, and day care centers have been analyzed at the metropolitan level (Baum & Singh, 1994a; Carroll & Huo, 1986; Hannan & Freeman, 1989), and populations of telephone companies, brewing firms, mutual banks, and other cooperative organizations have been studied at various regional and county levels (Barnett & Carroll, 1987; Freeman & Lomi, 1994; Staber, 1989; Swaminathan & Wiedenmayer, 1991). Similarly, wineries, semiconductor firms, and thrifts have been studied at the state level (Delacroix et al., 1989; Hannan & Freeman, 1989; Haveman, 1992), and populations of labor unions, trade associations, life insurance companies, and newspaper organizations have been analyzed at the national level (Aldrich, Staber, Zimmer, & Beggs; 1990; Amburgey, Dacin, & Kelly, 1993; Hannan & Freeman, 1989; Olzak & West, 1991; Ranger-Moore, Banaszak-Holl, & Hannan, 1991).

This variety of levels at which the relation between legitimation, competition, and organizational vital rates has been specified reflects, in part, an implicit assumption of the homogeneity of organizational populations with respect to spatial processes. Under this assumption, organizational populations are viewed as like biological populations with homogeneous mixing, populations in which every member is equally likely to interact with any other (Kephart, 1994). But organizational populations do differ considerably from biological populations in this respect because processes of disruptive selection, differentiation, and strategic positioning at the level of individual organizations give rise to local structures of interaction that make a priori assumptions of homogeneous mixing hard to maintain (Amburgey et al., 1994; Barnett, 1993; Baum & Mezias, 1992; Baum & Singh, 1994a; Swaminathan & Delacroix, 1991).

Understanding the role of localized structures in the evolution of organizational populations is essential to the progress of ecological theories for at least four reasons. First, the level of spatial aggregation implicitly determines the relevant context for legitimation and competition processes—that is, the population boundaries (Singh, 1993). Second, no specific theoretical guidance is available on what the most appropriate level of analysis might be (Carroll & Wade, 1991; Hannan & Carroll, 1992). Third, empirical studies are beginning to demonstrate that competitive and institutional processes are localized: not all organizations in a population compete for the same scarce resources or benefit equally from the presence (or absence) of other, similar organizations (Barnett & Carroll, 1987; Baum & Mezias, 1992; Freeman & Lomi, 1994; Haveman & Romanelli, 1994). Fourth, understanding the role of localized interaction may constitute a beginning point for clarifying the connection between organizational strategies and the ecological dynamics of organizational populations (Baum & Barnett, 1993). On the basis of the argument that markets and other institutional arenas eventually evolve to a national level, organizational ecologists usually specify population processes at that level (Hannan & Carroll, 1992). However, the propagation of organizational populations to national (and often supranational) levels does not imply spatial homogeneity. For example, the manufacturing belt in the United States, the tile cluster and the textile district in Northern Italy, the research triangle in North Carolina, the machine-tool district in Germany, the networks of suppliers surrounding the kaisha (leading manufacturers) in Japan, Silicon Valley, and Route 128 are all expressions that conjure up images of highly localized organizational activities (Best, 1990; Piore & Sabel, 1984; Porter, 1990; Preer, 1992).

The recurrence of patterns of organizational concentration in space across different industries and national contexts provides indirect evidence that location may be a general factor shaping the evolutionary dynamics of organizational populations. Spatial structure is important because processes, structures, and functions of organizational populations are defined in and by time and space (Dendrinos & Sonis, 1990; Hawley, 1986). Heterogeneity in a population's microstructure will result in localized responses to global ecological and institutional processes and produce differences in intrinsic founding rates, or unobservable location-specific "proneness" to experiencing the founding of particular organizational forms. These differences can be amplified over time by positive feedback related to externalities such as pooled labor markets for workers with industry-specific skills and other forms of information spillover among organizations, and they give rise to a variety of forms of spatial clustering (Arthur, 1986; Krugman, 1991).

But if organizations are sensitive to local conditions that can vary widely across locations, how can the evolution of organizational populations follow such regular aggregate patterns independent of the local strategies of individual organizations? Also, if organizational vital rates vary heterogeneously across population segments as a function of how individual organizations connect to their local environment (that is, to other organizations in their neighborhood), how could it be that the global evolution of organizational populations is driven by similar patterns of density dependence?

To address these conceptual issues in the population ecology of organizations, we propose a computational model of organizational evolution. According to this model, the macrodynamics of organizational populations emerge from simple microrules of local interaction that regulate the appearance, survival, and demise of individual organizations. The model is simulated under a variety of local evolutionary conditions to clarify how ecological macrodynamics interact with organization-level processes.

Understanding the full dynamics of organizational populations requires that both founding rates and mortality rates be considered together and that a complete birth and death process be specified in the same model (Carroll & Hannan, 1989: 427). Given the analytical complexities involved in specifying and estimating such a model empirically, we relied on microsimulation to learn whether and how the ecological processes related to density that are frequently observed in the study of empirical organizational populations are sensitive to different forms of localized interaction among individual organizations.

We had three main objectives for the study. The first was to learn more about the implications of localized processes of competition and legitimation for the evolution of organizational populations. The second was to establish an explicit connection between strategies of local interaction and their global population consequences or, in other words, between how individual organizations respond to (and anticipate) changes in their immediate competitive and institutional environments and the evolution of organizational populations. Finally, the third objective was to set an agenda for future research based on the premise that taking the role of local structures into account opens new frontiers for ecological theories of organizations and increases the potential of those theories to address a wide range of problems at the center of debate in other areas of contemporary research.

To accomplish these goals, the article is organized into four main sections. The first reviews theories and empirical studies that have addressed issues of location dependence and spatial structure in the evolution of organizational populations. The second section illustrates the basic formulation and discusses the methods used to specify and simulate the model. The third section describes and analyzes the results of a series of computer simulations. Finally, the fourth section discusses the implications of the results in the context of the main theoretical concerns addressed and outlines some directions for future research.

THEORY

Recent refinements of the theory of density-dependent organizational evolution have shown that processes of competition and legitimation controlling long-term changes in organizational populations are localized and that processes of organizational founding and disbanding vary systematically across levels of spatial aggregation (Lomi, 1995a).

Despite Hannan and Carroll's claim that "populations that experience transformations in geographical scale may be analyzed meaningfully at higher levels" (1992: 155), an increasing number of empirical studies have examined the relationship between spatial structure and vital rates in organizational populations. In one of the earliest contributions to this line of inquiry, Barnett and Carroll (1987) found that both local and nonlocal population densities affected the growth and mortality of telephone companies in southeast Iowa. Specifically, Barnett and Carroll found evidence of diffuse competition among early telephone companies and of commensalism between mutual telephone companies (companies owned by their subscribers and located in dispersed rural areas) and neighboring companies. Carroll and Hannan (1989) showed that density had the strongest effects on the vital rates of newspaper organizations located in large urban areas. In this study, density dependence was found to be a powerful force shaping the dynamics of large newspaper populations, but models estimated on small populations that operated in bounded urban areas failed to support the theory. In her critique of this study on newspapers, Zucker observed that this result is inconsistent because "smaller geographical areas should theoretically involve more intense competition since they are tightly bounded resource arenas" (1989: 543), a point also implicitly made by Carroll and Huo (1986).

Questions about spatial issues have become progressively more explicit. At least five studies have appeared that were specifically designed to address problems of spatial heterogeneity in the evolution of organizational populations. Carroll and Wade (1991) and Swaminathan and Wiedenmayer (1991) investigated patterns of density dependence among U.S. and German breweries, respectively, at the state, regional, and city levels. In the former study, Carroll and Wade found that processes of legitimation and competition manifested themselves more strongly at different levels of analysis for mortality and founding and that models of density dependence in founding rates were better specified at the regional level. In the latter study, Swaminathan and Wiedenmayer found evidence of density dependence at the national and state levels but found no evidence of density dependence in the mortality rates of breweries located in larger cities. Although the mortality of city breweries was not affected by the density of breweries outside of Bavaria, Germany's leading brewery region, the death rates of rural and small town breweries were significantly increased by non-Bavarian density. In general, both studies provided preliminary evidence of location dependence by showing that the effects of local densities on vital rates tended to be stronger than nonlocal density effects.

In their study of the Manhattan hotel industry, Baum and Mezias (1992) found that the effects of localized competition in terms of location, size, and price significantly increased hotel failure rates. Measuring localized competition by comparing the position of a focal hotel with the position of others within a given distance, they found that similarly sized, priced, and located hotels competed more intensely.

Freeman and Lomi (1994) estimated the effects of spatial heterogeneity on the founding of cooperative banks at the national and various regional levels. They found strong evidence of resource partitioning in the Italian banking industry and mixed evidence of density dependence in organizational founding rates when they included region-specific effects to control for spatial heterogeneity.

Haveman and Romanelli (1994) specified a number of models of rate dependence to explore alternative lag structures related to the geographical diffusion of foundings of U.S. savings and loan organizations. Although they found no evidence of differences in the timing of the effects of prior deaths on subsequent births over different levels of aggregation, Haveman and Romanelli found that local founding events had an immediate impact on potential entrepreneurs but founding events in more distant regions had a weaker effect on local entrepreneurial activity.

Finally, in a study of foundings of automobile manufacturers in five European countries, Hannan, Carroll, Dundon, and Torres (1995) found that although the overall density of European automobile producers legitimated firms throughout Europe, national densities predominantly had local competitive effects and depressed organizational foundings rates in all the continental countries included in the sample. This study provided at least some empirical support for the theoretical proposition that processes of legitimation and competition related to density operate at different levels of analysis; specifically, competitive processes tend to be localized while legitimation operates more broadly.

Although it may be premature to identify a clearly articulated approach to the study of local structures in the evolution of organizational populations, what this empirical literature does suggest is that location dependence may be a general process affecting the vital rates in organizational populations. In fact, these studies demonstrate that organizational populations are partitioned into segments defined spatially and that organizations in these segments respond heterogeneously to general competitive and institutional processes that depend on density (Lomi, 1995a). This conclusion is consistent, at least in part, with intuition because it is difficult to think of a real organizational population's resembling a fully connected graph in which each organization directly affects, and is affected by, every other. Ignoring the stylized duopolistic situations studied by economists and game theorists, in most cases the behavior of an individual organization is responsive only to that of a small number of neighboring organizations; for the purposes of this statement, numbers are "small" relative to the total population density, and organizations are "neighboring" if they are close along at least one dimension of the relevant resource space.

From this perspective, density dependence can be seen as emerging from a complex system of positional externalities determined by the fact that through the creation, absorption, and liberation of environmental resources organizations alter competitive conditions for other organizations and affect their behavior and survival chances (Delacroix & Rao, 1994). This system of positional externalities is particularly relevant in processes of organizational founding in which profit-maximizing entrepreneurs may interpret density and recent vital events as signals of expected profitability, or as proxies for risk. Such interpretations occur because "[f]ounding a new venture is risky business under any conditions, but especially so when entrepreneurs have few precedents for the kinds of activities they want to found" (Aldrich & Fiol, 1994: 645). As the number of organizations increases in a population that is far below its carrying capacity, so does the taken-for-grantedness and social acceptance of the corresponding organizational form. As the form gains acceptance and recognition, potential organizational founders will be able to concentrate their typically constrained attention more on how to make their ventures profitable and successful, and less on how to make their business ideas acceptable to venture capitalists, partners, workers, unions, and the press.

This ecological perspective on the relation between density and organizational founding rates is not inconsistent with a more conventional rational action perspective on organizational creation because, as Hannan and Carroll put it, "when legitimation of an organizational form increases, potential founders may come to believe that there are gains to be made when starting an organization . . . when competition intensifies potential founders postpone or cancel efforts to start organizations" (1992: 198).

Despite the theoretical commensurability of the ecological and the rational action perspectives on organizational creation, the main results of the studies on localized interaction and location-dependent vital rates are somewhat at odds with previous ecological literature emphasizing the role of diffuse competition and mutualism in the evolution of organizational populations. Diffuse competition implies that mutual awareness is neither a necessary nor a sufficient condition for the existence of competition among organizations. In this sense, the ecological notion of diffuse competition is somewhat "undersocialized" because it occurs among competitors largely anonymous to each other. Conversely, direct competition, sometimes called conflict or rivalry, implies mutual recognition and occurs between paired organizations each identifiable to the other.

The coexistence of direct and diffuse competition (i.e., of conflict and competition) is puzzling because although individual organizations craft their competitive strategies in reaction to—or in anticipation of—the behavior of a small number of other, clearly identified organizations, organizational populations evolve according to global processes of legitimation and competition. This idea reintroduces the opening questions of the article, because if organizations compete locally, but organizational populations evolve globally, questions arise about what level of analysis is the most appropriate and, more important, how different levels of action might be linked.

Specifically, we ask, How could it be that the microbehavior of local strategists who are capable of responding only to the actions of their immediate neighbors gives rise to the highly regular aggregate pattern of growth-stabilization-decline observed in empirical populations? In other words, what microevolutionary strategies are consistent with the aggregate empirical regularity of growth in density observed for so many kinds of organizational populations?

Answering these questions is both important and difficult. It is important because understanding the role of localized competition is crucial to the development of an explicit ecological and evolutionary approach to business strategy (Baum & Mezias, 1992). It is difficult because although ecological theories of organizations can be used to predict aggregate population dynamics, they provide no indications about the role, if any, of individual action (Hannan & Carroll, 1992; Shapira, 1994).

To clarify the connection between the vital dynamics of individual organizations and the macroevolution of organizational populations, we present a computational model of organizational evolution according to which the evolutionary strategy of an individual organization has a direct impact on the organization's immediate neighborhood and a diffuse effect on organizations operating in more distant sites. In this model, neighborhoods have partial overlap and share only some of their members. Thus, the behavior of an individual organization can propagate to distant sites by influencing the action of locally connected neighbors through a chain of connections (Cowan & Miller, 1990). We simulated the qualitative behavior of the discrete dynamical system implied by the model in order to explore alternative hypotheses about the link between rules of local interaction that regulate the appearance, survival, and extinction of individual organizations and the macroevolution of organizational populations.

METHODS

The Role of Simulation

There are four main motivations for relying on simulation methods to study the relationship between microbehavior and macrodynamics in the evolution of organizational populations. First, the full dynamics of organizational populations involve the analysis of organizational founding and mortality rates (Carroll & Hannan, 1989). Yet in the interest of specifying estimable models, empirical studies are forced to treat separately two components of community succession and evolutionary change. Because organizational founding and mortality rates have to be specified and estimated at different levels of analysis (population level for founding, organization level for disbanding), combining them into a single estimable expression is not a trivial task. Criteria for aggregation are needed to specify an empirical birth-and-death model, and no method for doing this is generally known (Hannan & Carroll, 1992). Second, rules and routines that regulate the appearance, survival, and extinction of individual organizations are essentially unobservable at the population level. Incorporating elements of microdynamics in ecological models is complicated because most of the available longitudinal data sets on organizational populations do not contain useful information on microprocesses (Hedstrom, 1992; Swaminathan & Delacroix, 1991). Third, ecological theories of organizations are silent on the role of individual action; hence, no guidance is available to discipline the search for empirical specification. Consequently, it is difficult to discriminate empirically between alternative microevolutionary processes and to test their macroimplications for the dynamics of organizational populations (Levinthal, 1992). Fourth, simulation methods are increasingly being used to further understanding of key issues in organizational ecology, such as the relationships between density and competition (Levinthal, 1992), learning and evolution (Mezias & Lant, 1994), and adaptation and selection (Levinthal, 1990). Computer simulation is also being used as a means of testing the qualitative long-term implications of empirical estimates (Carroll & Harrison, 1994; Hannan & Carroll, 1992: Ch. 8) and as a tool for the rigorous development of theories concerning problems that resist direct empirical analysis; these include the evolution of organizational size distributions (Hannan et al., 1990), the role of unobserved heterogeneity (Levinthal, 1991; Petersen & Koput, 1991), and the implications of learning capability (Bruderer & Singh, 1994; cf. Bruderer & Singh, this issue). This literature indicates that computer simulation can be as important as systematic empirical analysis for extending the frontiers of organizational ecology research (Masuch, 1995).

For these varied reasons, we relied on simulation to explore the macrolevel consequences of microlevel processes and to learn more about the link between structures of localized interaction and the evolution of organizational populations.

Models

According to the assumptions of homogeneous mixing commonly held in population biology, every member of a population is equally likely to compete with any other (Kephart, 1994). In fact, members of an organizational population may be connected to one another in many complex ways. For example, individual units (and individuals) may respond only to the behavior of a limited number of others with whom they have direct contact without being aware of the diffuse consequences of their actions (Schelling, 1972, 1978: Ch. 4).

We started by assuming that the connectivity among the members of an organizational population can be represented as a two-dimensional, regular lattice of size $n \times n$, in which every cell in the lattice represents a site potentially or actually occupied by an organizational entity. At any given time, each cell can be in only one of two states that for simplicity are coded as 0 for dead and 1 for alive. An organizational birth occurs whenever a cell changes its state from 0 to 1. An organizational death occurs when a cell changes its state from 1 to 0.

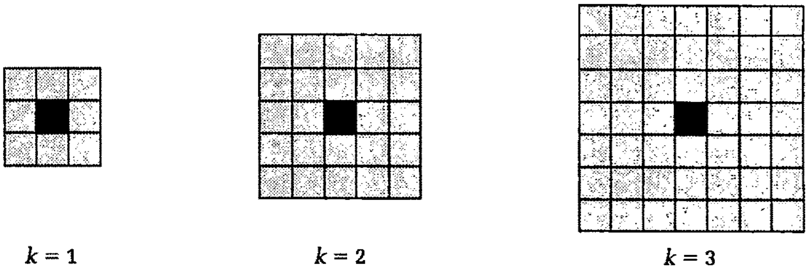
At any given time, the state of a cell depends on its own state and the states of a finite number of neighboring cells in the previous period. The size of the neighborhood, or "how local is local," depends on the value of a parameter (k) that controls the range of the rule for local interaction. For example, when $k = 1$, the neighborhood includes only the eight cells that touch a given cell. When $k = 2$, the number of cells in a neighborhood is 24 (plus the focal cell itself). Figure 1 shows that when $k = 3$, the local structure is defined in terms of the interaction among the 48 cells nearest to a given cell.

Now we need to establish how the vital dynamics of individual organizations depend on rules of localized competition among organizations in a given *k*-neighborhood. In keeping with the ecological literature on density dependence, organizational creation is modeled as a function of the number of organizations alive in a given neighborhood at a given time (Hannan & Freeman, 1989). In every time period, a cell on the lattice becomes active (an organization is founded) if density in its surrounding *k*-neighborhood reaches a given threshold level (Λ). As the value of Λ approaches unity, density will grow indefinitely, as it would be expected to do in a population of fast replicants in the absence of stringent resource constraints (Brittain & Freeman, 1980).

Organizational survival and mortality over time are regulated by the width of a density band in the *k*-neighborhood around each individual organization. If the number of organizations in a neighborhood is below a lower threshold (E_l) in a given time period, the focal organization will die of solitude in the next time period (a special case of death by lack of legitimacy). If the number of organizations in a neighborhood is above an upper threshold (E_u), the focal organization will die of overcrowding in the next period. As the survival band ($E_u - E_l$) diminishes, organizations become more sensitive to changes in their local environments.

In the models that we describe below, the range of local interaction is the same for legitimation and competitive processes because Λ, E_l, and E_u are defined in terms of the same value of *k*. Recent theoretical work on density-dependent organizational evolution suggests, however, that although a local level of analysis may be appropriate for analyzing competitive processes, legitimation effects are likely to transcend local boundaries because institutional norms and expectations diffuse more widely through a social system than the material resources used to build organizations (Hannan & Carroll, 1992: 146; Hannan et al., 1995). This theoretical indication is easy to incorporate in our models by simply defining *k*, which regulates the legitimation components (Λ and E_l) and k' ($< k$), which regulates the density-

FIGURE 1
Alternative Neighborhood Structures



dependent competition component (E_u) of the model.[1] Given space limitations, we decided that all these possible variations and complications of the baseline model would be best addressed in a series of more focused contributions. This simple setup also allows us to capture the main insights coming from empirical studies of rate dependence and population dynamics (Delacroix & Carroll, 1983; Delacroix, Swaminathan, & Solt, 1989; Hannan & Freeman, 1987, 1989). The death of an organization frees resources that can be used by potential founders because a new organization can occupy an abandoned site. However, the death of an individual organization may also trigger a chain of failures among neighboring organizations by lowering the number of organizations present in the neighborhood to below the local survival threshold E_l.

To formalize the qualitative argument developed so far, let (Λ_l, Λ_u and E_l, E_u) characterize the evolutionary conditions of an organizational form for which the number of organizations in the corresponding *k*-neighborhood must be strictly in the range $E_l - E_u$ for survival, and in the range $\Lambda_l - \Lambda_u$ for birth. Also, let

$$\alpha_{i,j}^{(t)} = \sum_{i=i-k}^{i=i+k} \sum_{j=j-k}^{j=j+k} a_{i,j}^{(t-1)}, \tag{1}$$

with

$$a_{i,j}^{(t)} = \left\{ \begin{array}{c} 1 \text{ if } E_l < \alpha_{i,j}^{(t)} < E_u \mid a_{i,j}^{(t-1)} = 1 \\ 1 \text{ if } \alpha_{i,j}^{(t)} = \Lambda \mid a_{i,j}^{(t-1)} = 0 \\ 0 \text{ otherwise} \end{array} \right\}, \tag{2}$$

where Equation 1 defines the number of cells alive in a *k*-neighborhood around $a_{i,j}$ at time t and Equation 2 is the updating rule that regulates the vital dynamics of each individual organization; in Equation 2, Λ ($= \Lambda_l = \Lambda_u$), E_l, and E_u define the survival conditions described above.[2,3]

In the following section, we address the global population properties of this model of local interaction among individual organizations assuming n equals 100, a figure that yields a potential population of 10,000 organizations.[4] In the analysis of the results, we were interested in learning more about the effects on the aggregate population dynamics of (1) changes in the local density threshold for organizational birth (Λ), (2) changes in the width of the local survival band for individual organizations (E_l, E_u), and (3) changes in the size of the neighborhood (k).

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[1] It would be equally simple to make k stochastic to allow for heterogeneity in individual responses to spatial processes. An alternative analytical strategy, one that we implemented in a simulation study of the iterated prisoner's dilemma (Lomi & Larsen, 1997), is to endow individual organizations with the computational power to process some form of global information representing, for example, society-level legitimation.

[2] All through the article, we assume that $\Lambda = \Lambda_l = \Lambda_u$, or that the number of organizations alive in the neighborhood of a given radius that is necessary for new organizations to be founded is equal to a fixed number.

[3] The model described by Equations 1 and 2 is essentially an outer-totalistic two-dimensional binary-state cellular automaton defined on a square lattice (Gutowitz & Victor, 1987; Packard & Wolfram, 1985). The specific model we use is a variation on Conway's well-known game of "Life" (Berlekamp, Conway, & Guy, 1982).

RESULTS

The analysis of the results is organized in two parts. In the first, we rely on a wide range of graphical representations to provide some concept of how the modeling framework works and the type of results it is capable of producing. The descriptive part is necessary because this modeling approach, which was introduced in the study of complex physical and biological processes only relatively recently (Gutowitz, 1991: Ch. 4), has not been applied before to the study of organizations and organizational populations. In the second part, we test the credibility of our models by using the synthetic data to estimate a simple model of organizational founding and show that the results obtained are comparable to those of empirical studies of actual organizational populations.

Dynamic Models of Local Interaction

Figure 2 illustrates the first four time steps in the evolution of the nearest-neighbor ($k = 1$) model under evolutionary conditions $\Lambda_l = \Lambda_u = 2$, $E_l = 3$, and $E_u = 7$. The five cells active at time $t = 0$ represent the initial condition of the system. At each time step, the state of every cell in the lattice is synchronously updated according to the rules determined by the evolutionary regime. For example, in Figure 2 the first cell from the left that is alive at the end of period 1 dies out by the end of period 2 because in period 1, density in the cell's 8-neighbor square fell below $E_l = 3$. The same cell (organization) became active (was founded) in period 1, because there were exactly two other cells alive in its 8-neighbor square at time $t = 0$.

The six space-time frames reported in Figure 3 illustrate the population growth path according to a 3-nearest-neighbors model ($k = 3$), with evolutionary conditions $\Lambda_l = \Lambda_u = 5$, $E_l = 10$, and $E_u = 30$ regulating the vital dynamics of individual organizations in overlapping 48-neighbor squares. For this specific rule, the sequence of frames shows the two-dimensional configurations emerging after the indicated numbers of generations. By generation 20, population density has grown to more than 500 organizations. The donut-shaped diffusion process leaves the central area of the population

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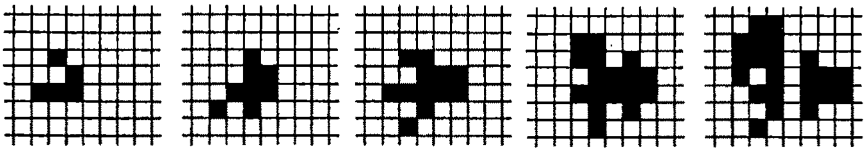
[4] A problem commonly encountered in the literature on cellular automata concerns the boundary conditions of the system (Wolfram, 1983). One solution is to impose periodic boundary conditions whereby the lattice is bent and the cells are arranged on a torus. The second solution is to assign a fixed value to the m nearest cells to the boundary. Here we follow this latter method and correspondingly reduce the number of effective cells on the lattice to $(n - 2m)^2$.

FIGURE 2
Dynamics of Local Structures in a Nearest-Neighbor Model[a]



	Time = 0	Time = 1	Time = 2	Time = 3	Time = 4
Density	5	8	12	17	22
Birth	5	5	5	7	8
Death	0	2	1	2	3

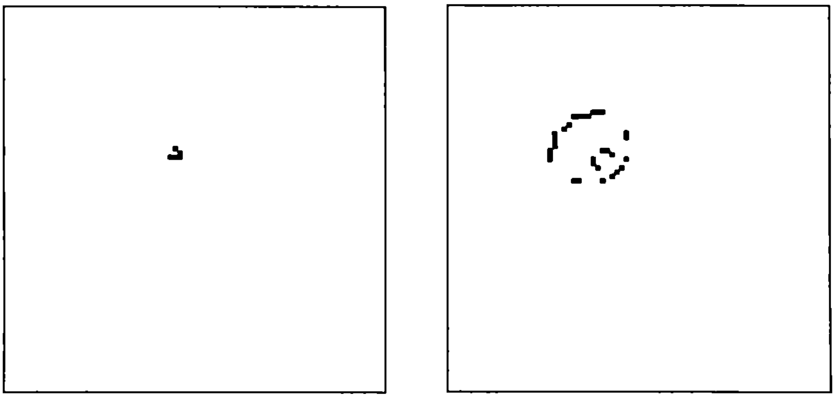
[a] Evolutionary conditions are $\Lambda_l = \Lambda_u = 2, E_l = 3, E_u = 7$.

space empty while creating identifiable organizational clusters at the periphery. As density increases further, most of the sites have been active at least once, and smaller localized structures begin to emerge. By generation 50, the population has reached a quasi-stead-state density fluctuating around 1,600 units with no tendency to increase further since the new births are compensated for by a comparable number of deaths. In spite of the continuous turnover at the population level, several local clusters reached a stable configuration that remained unchanged between time 30 and time 50.

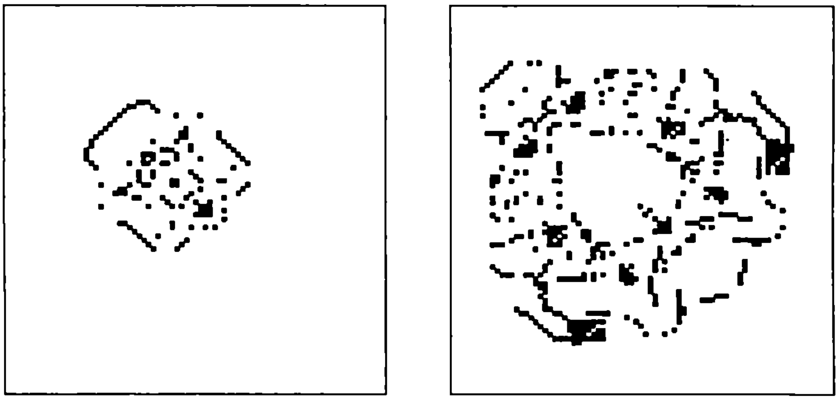
This modeling framework allows great flexibility in experiencing with a variety of possible rules of local interaction and evolutionary conditions. Flexibility, does not however, imply that interesting collective behavior can emerge from random interaction at the micro level. To illustrate this important point, Figure 4 represents a situation in which in every round organizations flip an imaginary coin to determine their state (alive or dead) in the next time period. As one would expect, this system with random interaction does not display any tendency toward self-organization over time. In this situation of complete density-independent evolution, the configuration reached by the system at times $t = 1$ and $t = 50$ (and in successive periods) are equally disordered.

The next step is to impose some restrictions on the evolutionary conditions that regulate the vital dynamics of individual organizations. Figure 5 shows the different configurations reached by four populations simulated under different founding and mortality conditions after 100 time periods. In Figure 5a, the dynamics of the organizational populations are controlled by evolutionary conditions $k = 1$, $\Lambda_l = \Lambda_u = 2$, $E_l = 2$, and $E_u = 7$. In practice, this means that a new organization will appear in the population if exactly 2 others are present in its surrounding 8-neighbor square and that an existing organization will disappear if there are fewer than 2 or more than 7 other organizations alive in the same neighborhood. These conditions of local interaction result in an almost homogeneous distribution of organizations in the population (although with some noticeable localized structures) and an overall "tight packing" by generation 100. The structure of organizational populations is extremely sensitive to changes in the rules of local interac-

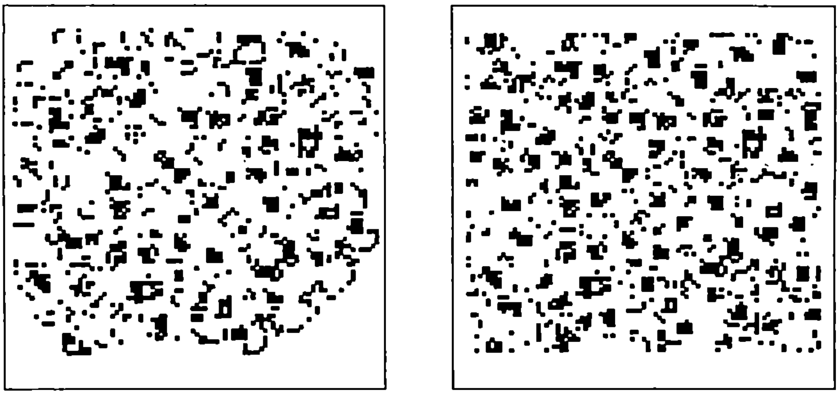
FIGURE 3
Space-Time Patterns in the Evolution of an Organizational Population[a]



Time = 0, Density = 5 Time = 5, Density = 31



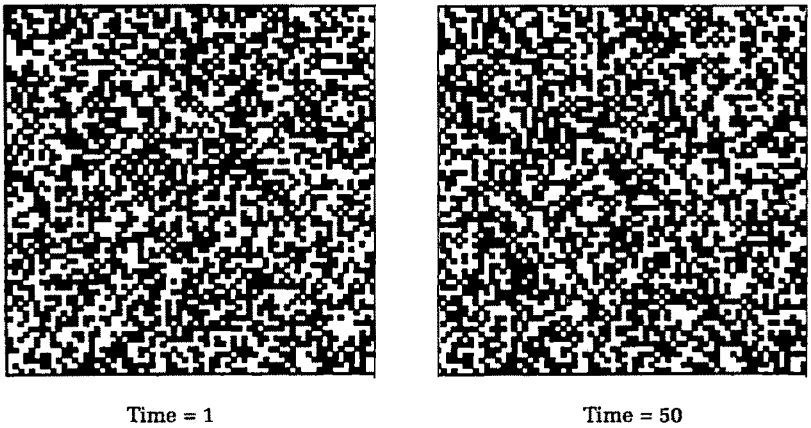
Time = 10, Density = 126 Time = 20, Density = 534



Time = 30, Density = 1,347 Time = 50, Density = 1,628

[a] Evolution is over 50 successive generations according to evolutionary conditions $k = 3$, $\Lambda_l = \Lambda_u = 5$, $E_l = 10$, $E_u = 30$.

FIGURE 4
Population Evolution Determined by Random Interaction among Individual Organizations



tion. For example, the space-time frame of Figure 5b shows that the density after 100 generations is much lower (2,611 vs. 4,638) for this population evolving according to $k = 2$, $\Lambda_l = \Lambda_u = 3$, $E_l = 6$, and $E_u = 20$. Members of the populations now display some tendency toward clustering.

An interesting result suggested by the comparison of Figures 5a and 5b is that as k increases—that is, as the number of units directly affecting the focal organization increases—the population becomes more spatially differentiated. The second interesting result emerging from the comparison of Figures 5c and 5d is that, ceteris paribus, the location of the survival band has a strong effect on the long-run population density. The dynamics of the organizational populations represented in Figures 5c and 5d are regulated by identical evolutionary rules. The only difference is the location of the survival band (i.e., of the segment of length $E_u - E_l$) along the interval $[0 - (2k + 1)^2]$ that defines its range of variability.[5] Note that the absolute width of the survival band is 10 in both models. By generation 100, density in the two populations differs by about 15 percent, but the population in Figure 5d (with survival band 50–40) has a more noticeable tendency to become partitioned into discrete clusters of interacting organizations than the population in Figure 5c (where the survival band is 30–20).

Thus, the relative location of the survival band influences both the total number of organizations that a given population can sustain and the distribution of those organizations in space and time. Density is regulated by the extent to which interaction is localized. Populations in which the process of competition and legitimation related to density operate over larger neigh-

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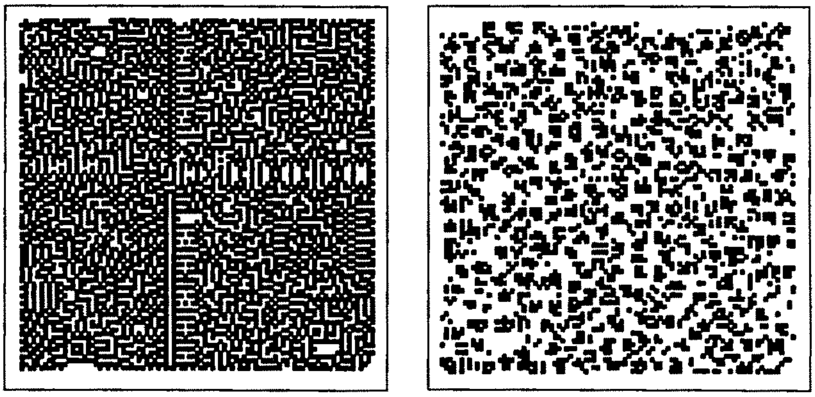
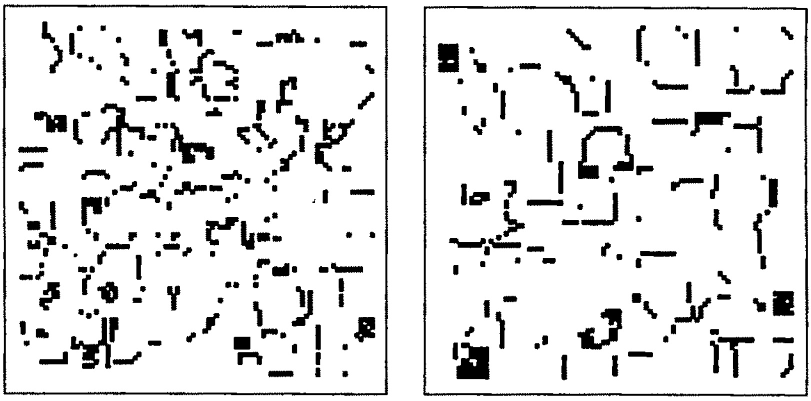
[5] The maximum value of the upper limit of the survival band is $\max E_u = (2k + 1)^2$, or the maximum number of organizations that can exist in a given k neighborhood.

FIGURE 5
Space-Time Frames Illustrating Sensitivity of Population Density and Structure to Rules of Local Interaction among Individual Organizations



(a) Time = 100, Density = 4,638
$k = 1$, $\Lambda_u = \Lambda_l = 2$, $E_u = 7$, $E_l = 2$

(b) Time = 100, Density = 2,611
$k = 2$, $\Lambda_u = \Lambda_l = 3$, $E_u = 20$, $E_l = 6$



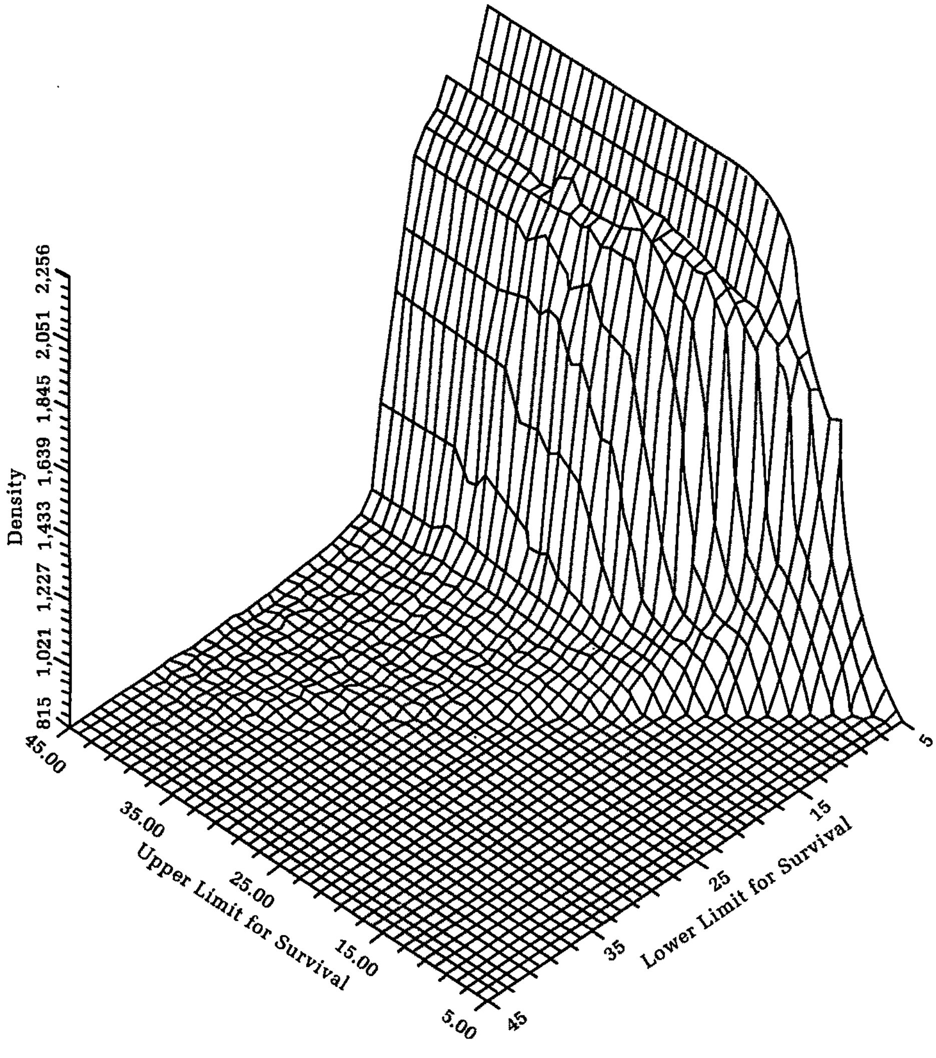
(c) Time = 100, Density = 782
$k = 3$, $\Lambda_u = \Lambda_l = 3$, $E_u = 30$, $E_l = 20$

(d) Time = 100, Density = 667
$k = 3$, $\Lambda_u = \Lambda_l = 3$, $E_u = 50$, $E_l = 40$

borhoods (in which each organization is directly influenced by, and influences, a comparatively large number of neighboring organizations) seem to be generally smaller than populations characterized by more localized interaction.

To better explain the relationship between density and the width of the survival band, in Figure 6 we plot population density as a function of E_l and E_u (with $E_u > E_l$). The three-dimensional plot represents the results of 800 simulation runs in which E_u and E_l are left free to vary between 5 and 45 (again imposing the obvious restriction $E_u > E_l$) but k and Λ_l (=Λ_u) are kept fixed at 3 and 4, respectively. For each simulation, the average steady-state density between times 200 and 400 was calculated and plotted as a function of the upper and lower limits of the survival band. As expected, Figure 6 shows that the larger the survival band ($E_u - E_l$), the higher the long-term average density. However, this relation is highly nonlinear, and survival bands with the same absolute width have different impacts on density depending on the location of the segment $E_u - E_l$ along the interval [0 – (2*k* +

FIGURE 6
Population Density as a Function of the Width of the Survival Band for Individual Organizations



$1)^2]$. As soon as the lower limit for survival (E_l) is increased above 16, the average long-term density drops sharply, independently of the value of the upper survival threshold (E_u). The lower survival limit seems to have a critical value in the 3-nearest-neighbors model. When the critical value is crossed from below, the overall population growth rates are severely depressed. The substantive interpretation of this result is that the dynamics of organizational populations are constrained much more strongly by legitimation (connected to the lower limit) than by competition (connected to the upper limit). If the legitimation requirements for a given form are sufficiently high, the organizational density will be depressed even in the absence of strong competitive pressure.

Having established, at least qualitatively, that the overall dynamics of an organizational population are sensitive to rules of local interaction and to the range of the local neighborhood, we asked, To what extent can our models replicate the aggregate growth path of density observed in actual organizational populations? Can the models reproduce patterns that are broadly consistent with empirical observations? Figure 7a shows that the $\Lambda_l = \Lambda_u = 2$, $E_l = 3$, $E_u = 7$ model with nearest-neighbor interaction produces a "classic" logistic growth pattern that reaches steady-state density after about 100 generations. Figures 7b and 7c show that the aggregate growth path of density is highly sensitive to changes in the microconditions regulating the vital dynamics of individual organizations—the patterns of local interaction.

Links to Empirical Studies

To test the credibility of our conclusions, we used some of the systemic data produced by simulation to estimate a simple log-quadratic model of density-dependent founding rates. We did so because we wanted to compare the statistical estimates obtained for artificial populations with those reported by empirical studies of actual organizational populations. Because space is constrained, we concentrated on the analysis of organizational founding (of the state transitions from $t = 0$ to $t = 1$), leaving the analysis of mortality to a future study.[6]

We used the method of maximum likelihood to estimate a conventional Poisson model of organizational founding with a general regression structure: $\lambda = \exp(\beta_1 N + \beta_2 N^2)$. Both the models and the parameter estimates gave results significant at the 0.0001 level and in the direction predicted by the

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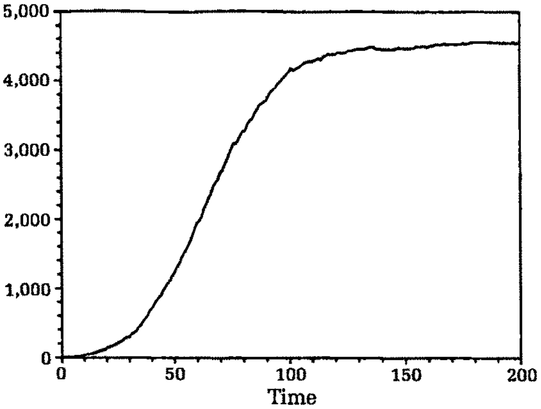
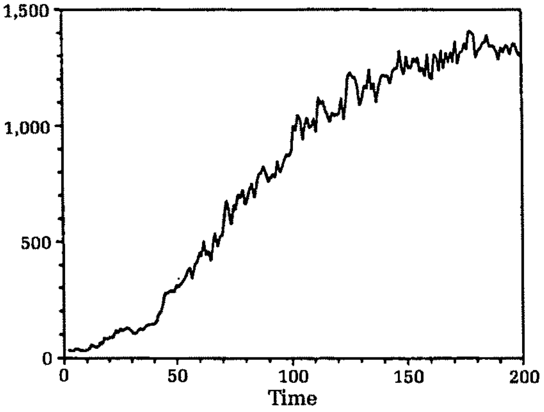
[6] Analyzing organizational mortality using the data produced by our model is possible both in principle and in practice. One slight complication derives from the fact that the synthetic data are not exactly comparable to empirical data on organizational event-histories because our models work in discrete time, and hence organizational age (or duration) can only take on integer values. In the analysis of organizational creation this problem is avoided by analyzing aggregate series of event counts; this possibility is precluded in the study of mortality, where the unit of observation is the individual organization. Exploratory analyses based on nonparametric survival models estimated on the same synthetic data used in the present study show a clear connection between the range of local interaction and duration dependence in organizational mortality.

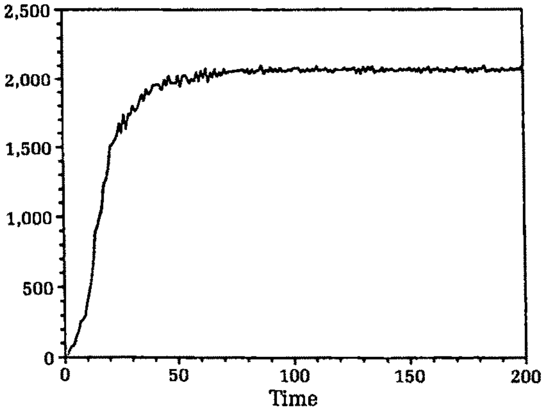
FIGURE 7
Density Trajectories Produced by Alternative Rules of Local Interaction



(a) $k = 1$, $\Lambda_l = \Lambda_u = 2$, $E_l = 3$, $E_u = 7$



(b) $k = 3$, $\Lambda_l = \Lambda_u = 5$, $E_l = 12$, $E_u = 35$



(c) $k = 3$, $\Lambda_l = \Lambda_u = 5$, $E_l = 12$, $E_u = 35$

TABLE 1
Density Dependence in Organizational Founding Rates[a]

Parameter Estimates	Model 1: $k=1$; $\Lambda_l=\Lambda_u=2$, $E_l=3$, $E_u=3$	Model 2: $k=3$; $\Lambda_l=\Lambda_u=3$, $E_l=5$, $E_u=35$
β_1	0.0016	0.0046
$\beta_2/1{,}000$	−0.00034	−0.0023
N_{min}	8	11
N_{max}	4,643	2,136
N^*	2,371	961
λ^*	6.48	9.49
$\tilde{\lambda} = \lambda(N_{max})/\lambda^*$	0.169	0.05

[a] Estimates are based on synthetic data.

theory of density dependence. In the discussion of the results that follows, we concentrate more on the numerical implications of the estimates and less on issues related to their individual and joint statistical significance.[7] The discussion of the qualitative implications of the results is organized around Table 1.

In the table, β_1 and β_2 are the numerical values of the maximum likelihood estimates of the marginal effects of density; N_{min} and N_{max} denote the minimum and maximum values of density in the simulated populations; N^* denotes the level of density at which the founding rate reaches its maximum value (λ^*). Finally, $\lambda(N_{max})$ represents the value of the multiplier of the founding rate when density is at its observed maximum. The quantity $\tilde{\lambda} = [\lambda(N_{max})/(\lambda^*)]$ measures the extent to which the founding rate drops from its peak when density reaches its maximum observed value. Model 1 and 2 in Table 1 differ in terms of the fundamental parameters that regulate the evolution of the organizational populations. For example, model 1 implies that direct local interaction exists only among organizations in overlapping 8-neighbor squares. Model 2 implies that the state of each organization at time t is a function of the states of all the organizations in a surrounding 48-neighbor square at time $t - 1$. As expected, the larger the number of directly interacting organizations, the stronger the effects of density on the founding rate. In the population generated by model 1, the maximum founding rate is about 6 times that at minimum density, and the maximum rate is about 9 times that at minimum density for the population generated by model 2.

In the first artificial population, the founding rate at maximum density is about 17 percent of the maximum rate and, in the second artificial population, when density reaches its maximum the founding rate drops by 95 percent from its peak. The numerical value for the first artificial population is comparable to the value estimated by Lomi (1995a) in his study of foundings of Italian cooperative banks, where the founding rate at maximum density was estimated to be 18 percent of the maximum rate. In both cases, the dependence of (synthetic and empirical) organizations on their local environments apparently made the competitive effects of density weaker.

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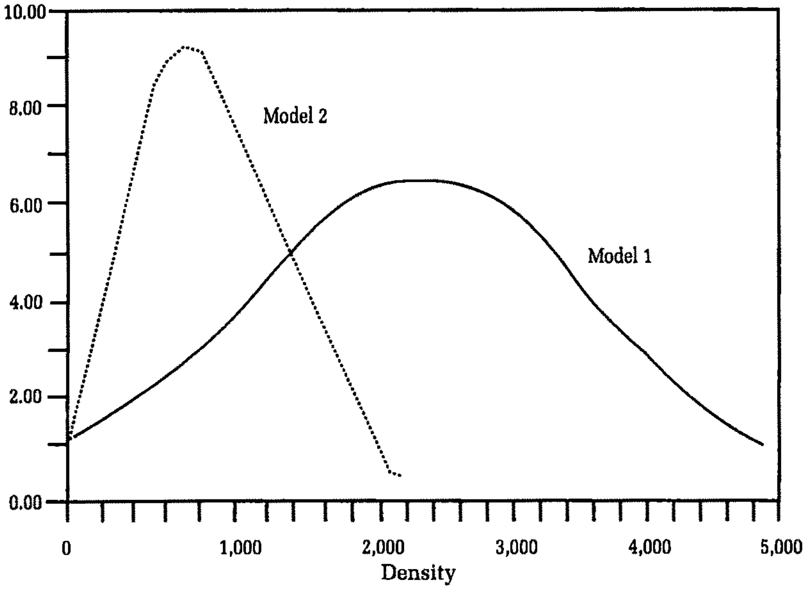
[7] The restriction on the variance implied by the Poisson model may lead to underestimation of the standard errors if overdispersion is present. However, the numerical estimates of the parameters are virtually unaffected when models with gamma mixture are adopted because what varies across alternative specifications is the form of the variance function. In the present case, the parameters and their statistical significance were very stable across alternative specifications.

The numerical value of $[\lambda(N_{max})/(\lambda^*)]$ estimated for the second artificial population (0.05) is very close to the value estimated by Hannan and Carroll (1992: Chs. 4 & 5) for American mutual life insurance companies (0.03). In both cases, the rate reaches its maximum at relatively low levels of density and drops off sharply afterwards, indicating a strong effect of density-dependent competition. Unlike Italian cooperative banks, which are constrained by regulation to operate at a strictly local level (Lomi, 1995a), U.S. life insurance companies compete at the national level; thus, the vital dynamics of individual organizations are likely to be directly affected by the action of organizations existing at a distance (Hannan & Carroll, 1992: 228).

Figure 8 illustrates the qualitative implications of the results just discussed in plots of the effects of density on the organizational founding rates in the two artificial populations. Despite the general agreement of these

FIGURE 8

Multipliers of the Organizational Founding Rates According to Maximum Likelihood Estimates[a]



[a] See Table 1 for estimates.

results with empirical studies of organizational founding, two related sets of questions arise concerning (1) the sensitivity of the estimates of the first- and second-order effects of density to variations in the range of local interaction and (2) the robustness of the results to changes in the basic parameters that define the evolutionary conditions for the populations.

To address the first series of questions, we ran 200 additional simulations of the two models experimentally, varying the width of the survival band. In the nearest-neighbor ($k = 1$) model, we varied E_l between 1 and 7 and E_u between 2 and 8 and tried all 28 possible combinations. In the $k = 3$ model, we varied E_l between 5 and 39 and E_u between 6 and 40. In this case, we covered about 32 percent of the 544 possible combinations. We did so because we wanted to learn if models defined in terms of different ranges of local interaction ($k = 1$ and $k = 3$) could induce empirically distinguishable patterns of density dependence. Specifically, we asked, How difficult would it be to vary the evolutionary conditions of model 1 and produce estimates of density effects that are close to those of model 2? Figure 9a reports the relative frequency distribution of the estimates of the first-order effects of density ($\beta_1^{(k=1)}$, $\beta_1^{(k=3)}$) obtained by analyzing the data produced by the $k = 1$ and $k = 3$ models, respectively. Figure 9a shows that $\beta_1^{(k=1)}$ and $\beta_1^{(k=3)}$ overlap between 0.002 and 0.004. The same figure also shows that the effect of density-dependent legitimation on the founding rate becomes on the average 80 percent stronger as the range of local interaction increases from 1 to 3. Figure 9b reports the relative frequency distribution of the estimated absolute value of the second-order effects of density ($\beta_2^{(k=1)}$, $\beta_2^{(k=3)}$) implied by the $k = 1$ and $k = 3$ models, respectively. As before, the absolute value of the numerical estimates of $\beta_2^{(k=1)}$ and $\beta_2^{(k=3)}$ have a narrow area of overlap between 0.000001 and 0.0000015. However, the absolute value of the second-order effect of density becomes on the average three times bigger as we move from an 8-neighbor-squares model to a model in which local interaction is defined over partially overlapping 48-neighbor squares.

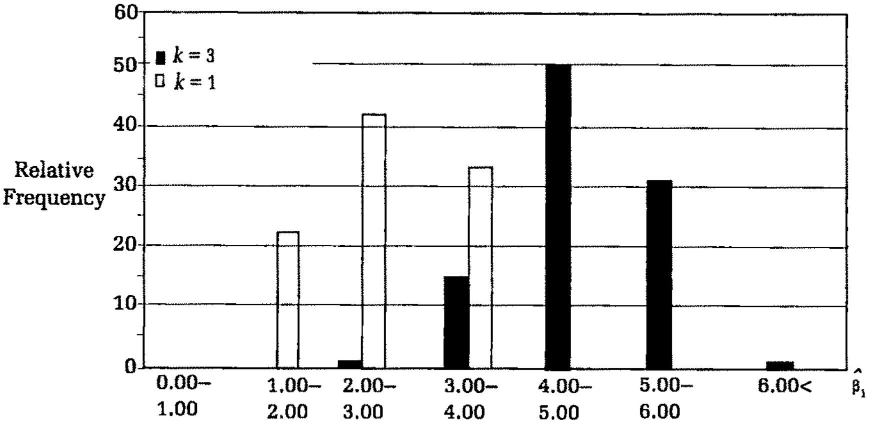
We now move on to an account of our exploration of the second series of questions related to the robustness of the results to changes in the basic parameters that define the evolutionary conditions for the population. Specifically, we asked, What are the boundary conditions under which the microlevel rules specified in our models lead to results that support the theory of density dependence at the population level? To address this question, we varied the conditions of local interaction Λ_l, Λ_u, E_l, and E_u and estimated corresponding Poisson regression models of organizational founding at the population level. Table 2 reports the range of results produced by iterative maximum likelihood estimation of the density parameters. Each of the 200 different models that we simulated was defined in terms of a unique combination of Λ_l, Λ_u, E_l, and E_u and was allowed to run for 200 generations.

The table confirms that the effects of density dependence on the organizational founding rate tend to become stronger as the range of local interaction increases (β_1 and β_2). As a consequence, organizational populations in which competition is more global tend to be characterized by a lower

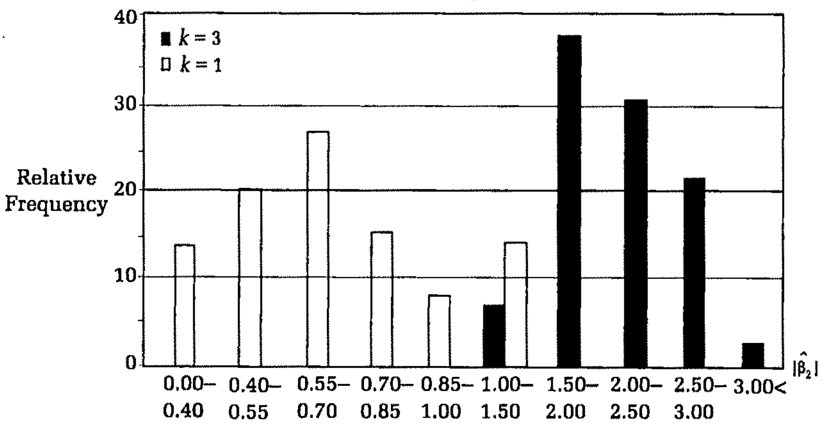
FIGURE 9

Effects of Density Dependence on Founding Rates

(a) Estimated first-order effects of density (β_1) implied by the $k = 1$ and $k = 3$ models.



(b) Estimated second-order effects of density ($|\beta_2|$) implied by the $k = 1$ and $k = 3$ models.



density ($N_{\max}$) because the multiplier of the founding rate reaches it maximum faster than in populations in which competition is more local (N^*) and because the multiplier of the rate drops off more steeply from its peak as density approaches its maximum (λ in Table 2). This observation is generally consistent with recent empirical studies of populations whose evolutionary dynamics are shaped by forces that transcend national boundaries (Hannan et al., 1995) and with the results of comparative studies on the ecological dynamics of alternative organizational forms (Lomi, 1995b). We also note that the magnitude of the numerical values reported in Table 2 are broadly consistent with received empirical evidence. For example, in their study of founding in a variety of organizational populations, Hannan and Carroll

TABLE 2
Relationship Between Density and Organizational Founding Rates[a]

Parameter Estimates	Model 1	Model 2
Range of local interaction	$k=1$	$k=3$
Founding threshold	$1 \leq \Lambda_l=\Lambda_u \leq 3$	$\Lambda_l=\Lambda_u=3$
Survival band, lower limit	$1 \leq E_l \leq 8$	$5 \leq E_l \leq 39$
Survival band, upper limit	$2 \leq E_u \leq 9$	$6 \leq E_u \leq 40$
Observed range[b]		
β_1	0.00146–0.00358	0.00255–0.00743
$\lvert\beta_2\rvert/1,000$	0.000287–0.005	0.00127–0.0043
N_{min}	5–14	11–11
N_{max}	1,826–5,531	961–2,143
N^*	1,530–2,859	934–1,348
λ^*	5.82–20.77	6.743–22.83
$\tilde{\lambda} = \lambda(N_{max})/\lambda^*$	0.028–1	0.05–1

[a] Results obtained by iterative maximum likelihood estimation across 200 simulations.

[b] Minimum to maximum.

(1992) found that the value of λ^* varied between 1.2 (Argentine newspapers) and 20 (U.S. brewers) and that the value of $\tilde{\lambda}$ varied between 0.03 (U.S. life insurance companies) and 1 (San Francisco–area newspapers).

The estimates of β_1 and β_2 always supported the density-dependence model strongly. In fact, we could not find a single combination of evolutionary conditions that violated the theoretical constraints suggested by the model ($\beta_1 > 0$, $\beta_2 < 0$, and $\lvert\beta_2\rvert < \lvert\beta_1\rvert$). But what are the qualitative implications of these numerical estimates for the relationship between density and organizational founding rates? To answer this question, we studied how $\tilde{\lambda}$ varied as a function of the width of the survival band ($E_u - E_l$) and of the level of the founding threshold (Λ). We did so because $\tilde{\lambda}$ provides crucial information on the strength of density-dependent competition relative to legitimation and is therefore a parameter of great theoretical importance. Since its value is between 0 and 1, $\tilde{\lambda}$ is also easily comparable across organizational populations, and it can be used to assess the consistency of our simulations with the results of studies of founding in real-life organizational populations. When $\tilde{\lambda}$ is very small (close to 0), density-dependent competition is very strong relative to legitimation, and the founding rate drops off rapidly from its peak as density increased beyond N^*. Empirically, this was found to be the case in the population of U.S. life insurance companies, where competition tended to dominate legitimation both in absolute and in relative terms (Hannan & Carroll, 1992). At the other extreme, when $\tilde{\lambda} = 1$, it follows that $\lambda^* = \lambda(N_{\mathrm{max}})$, and the founding rate reaches its maximum at maximum density. Empirically, this was found to be the case in populations of newspaper organizations located in Ireland and the San Francisco area (Hannan & Carroll, 1992). Hannan and Carroll (1989) found a similar relationship between density and founding rates in an earlier study of newspadependent founding rates is consistent with a number of microassumptions about the patterns and range of local interaction among individual organizations. The analysis also shows, however, that the shape and strength of the relationship between density and organizational founding rates at the population level is highly sensitive to the microstructure of local connections among individual units.

DISCUSSION AND CONCLUSIONS

Empirical studies have demonstrated that competitive and institutional processes are localized; not all organizations in a population compete for the same scarce resources, nor do they benefit equally from the presence (or absence) of other, similar organizations. These studies show that processes of resource partitioning, strategic differentiation, and disruptive selection work to reduce the number of competitors that each organization faces in a population. In the light of this ecological evidence, we claimed that understanding the population-level consequences of local interaction among individual organizations is crucial to the progress of ecological theories of organizations because (1) the level of aggregation involves a redefinition of the population boundaries, the relevant context for legitimation and competition processes (Singh, 1993), (2) population ecology theories of organizations offer no specific guidance on the appropriate level of aggregation (Carroll & Wade, 1991), and (3) the possibility of building a bridge between ecological theories of organizations and more traditional approaches to competitive strategy hinges on understanding how the global evolutionary dynamics of organizational populations emerge from the interdependent actions of local strategists. Prompted by these concerns, we proposed a computational model of organizational evolution according to which the global dynamics of organizational populations emerge from simple rules of local interaction among individual organizations. The model was simulated under a variety of evolutionary conditions and its behavior shown to be in qualitative agreement with empirical observations of organizational populations.

The results of this study provide new insight into the relationship between localized processes of competition and legitimation and the evolutionary dynamics of organizational populations. In particular, the range of a neighborhood, defined as the number of competitors directly affecting, and being affected by, a focal organization, was found to have a powerful effect on the propagation features of the organizational population. Populations composed of individual organizations that are affected directly by, and affect, a comparatively large number of others seem to reach carrying capacity at lower levels of density. This qualitative result is broadly consistent with empirical observations in the sense that populations of generalists, which by definition interact with a greater number of other organizations because they compete in several markets, tend to be less dense than populations of specialists (Barnett, 1993; Baum, 1994; Brittain & Freeman, 1980). One interesting aspect of this conclusion is that this qualitative feature of the organizational world is reproduced by our models even in the absence of any size differentials among individual units, and merely as the consequence of a pure selection process emerging from differences in patterns of interorganizational relations.

The founding rate of organizations operating in more restricted local neighborhoods was found to respond less strongly to population-level processes of legitimation and competition related to density. In the analysis of organizational founding based on synthetic data, the maximum effect of density on the founding rate became approximately 50 percent stronger when we moved from a model with 8-neighbor squares ($k = 1$) to a model with 48-neighbor squares ($k = 3$).

These conclusions are consistent with those of empirical research that has found mixed evidence of density dependence in the founding rates of organizations that are very sensitive to variations in their local environments, such as local unit banks (Freeman & Lomi, 1994), and day care centers (Baum & Singh, 1994a). Also consistent with empirical research is the result about the relationship between the range of a local neighborhood and the strength of density-dependent competition. For example, the founding rate of American life insurance companies—organizations that, according to Hannan and Carroll (1992: 228), operate at the national level—dropped by 97 percent from its peak as density reached its maximum sample value. The analysis of the data simulated according to a model with local interaction defined over 49-neighbor squares revealed that in this artificial population the founding rate dropped by 95 percent from its peak as density approached its maximum value.

The findings also indicate that the evolutionary dynamics of organizational populations are extremely sensitive to changes in the width of the survival band for individual organizations. Specifically, when the lower limit is sufficiently high, organizations cannot survive outside localized clusters as they become extremely sensitive to problems of density-dependent legitimation. When the upper limit of the survival band decreases, individual organizations can survive only in relative isolation because they become progressively more sensitive to overcrowding, or competition from numbers. This results may help explain why production in many industries is concentrated in space and how center-periphery patterns come to characterize the structure of many technical and institutional sectors. If forces exist that give a competitive advantage to organizations located near other organizations or in specific geographical areas, then the internal structure of the population can no longer be considered homogeneous, and organizational vital rates will vary systematically across locations. This conclusion has far-reaching implications for the future development of ecological theories of organizations because it implies that the complex microstructure of organizational populations mediates and qualifies generic processes of competition and legitimation.

In general, the findings of this study demonstrate that by explicitly recognizing the importance of local structures for the global properties of the dynamics of organizational populations, it is possible to develop a rich class of models. In the two-dimensional lattice structures underlying our modeling effort, individual organizations operate in partially overlapping neighborhoods, and the behavior of an individual organization has a direct impact on that organization's immediate neighborhood and a diffuse effect on organizations operating in more distant sites. This abstract framework has an intuitive appeal for interpreting many real-life situations because, as Boeker put it, "The interaction of competitors is a critical element in strategic management since the success of one firm's strategy often depends on the action of others" (1991: 613). Following this argument, Baum and Singh (1994a, 1994b) analyzed how patterns of niche overlap and nonoverlap influence entrepreneurial activity and organizational mortality. They found that overlap density (defined as population density weighted by the overlap of a focal organization's resource requirements with those of all other organizations) had a competitive effect on founding rates and that nonoverlap density had positive effects on the founding rate in a population of day care centers in Metropolitan Toronto. Baum and Singh found that their results supported existing theories of density dependence at the population level, but localized structures significantly influenced which organizational niches entrepreneurs chose in creating new organizations and the likelihood of enduring different survival fates after founding as a function of location. In this and other recent empirical studies, disaggregation of population density into discrete subcategories has revealed complex patterns of interactions among individual organizations. Similarly, in our experiments we found that density dependence was consistent with a wide range of microassumptions but that patterns of local interaction among individual organizations strongly influenced the shape and strength of the relationship between population density and organizational vital rates. This discussion naturally opens the door to the problematic relationship between the action of individual organizations and the evolution of organizational populations in the presence of positional externalities—in situations in which individual action modifies the frame of reference for others (Frank, 1992; Shapira, 1994). Our approach to the relationship between microlevel behavior and macrolevel structure shows how ecological theories can address issues at the heart of business strategy research because, as Schelling noted, "If people need to know how others are choosing to make their own choices, it will matter whether or not they can find out what everybody is doing" (1978: 215).

The lattice models simulated here can be modified to represent a wide range of binary (and multiple) choice situations with positional externalities, and hence to allow researchers to explore the links between mainstream views of business policy and strategy, which are typically based on micromodels of individual choice, and ecological theories—typically based on macromodels of evolution in organizational populations. Direct interpretation of the results of a simulation in the context of a discrete choice model with externalities is, however, possible only to the extent to which it makes sense to claim that individual organizations "choose" to die. When simulation results are interpreted in an individual choice framework, it is crucial to identify exactly who the "individuals" are. When the subjects of the models are not natural persons, but constructed actors, such as formal organizations, researchers tend to resist the temptation to impute too much capacity for rational actions to them. As Hannan noted, "The actions of individuals as they affect macroprocesses cannot be summarized by the actions of the organizations they construct and maintain, as would be the case in a fully nested system" (1992: 121).

More work is required to specify a choice mechanism that regulates local interaction in a way that is both theoretically interesting and empirically credible, and we are already making first steps in this direction (Lomi & Larsen, 1996). The modeling framework that we adopted in this research is very flexible and can be easily extended to situations with more than two states in which organizations can not only die, but can also grow, decline, and differentiate. In our view, this direction of research holds great promises for the progress of both organizational ecology and theories of business strategy.

In its current simplified form, our representation of the evolution of organizational populations is clearly far from fully satisfactory. In the discussion of the limitations of the study, it is useful to separate limitations that are inherent to the modeling framework we adopted from assumptions that are restrictive in the present context but do not necessarily imply a loss of generality. The first basic limitation of the modeling framework is its synchronous updating mechanism. The state of every site on the lattice is updated at the same discrete time steps. Although this computational structure is generally considered a reasonable assumption in models of physical and chemical systems (Wolfram, 1986), its realism for modeling the mechanics of social and ecological processes can be questioned (Hogeweg, 1988). Despite this inherent limit, models inspired by the theory of cellular automata are beginning to be applied to such traditional social science problems as macroeconomic cycles (Albin, 1987), market structure, collusion, and competition (Albin & Foley, 1992; Keenan & O'Brien, 1993), and the emergence of political elites (Brown & McBurnett, 1993). To the best of our knowledge, the current work represents the first attempt to apply this analytical framework to a problem in the theory of organizations.

The second limitation concerns the fact that we used the same rule, or set of evolutionary conditions, to update the state of every cell in the lattice. In principle, it is possible to think of different rules competing for sites or to design individual cells that draw a set of evolutionary rules from a distribution of possible configurations (or combinations of k, Λ_l, Λ_u, E_l, and E_u). We are not aware, however, of any work that has implemented such a model, possibly because—if the number of possible combinations is left unconstrained—the computational burden quickly becomes prohibitive.

A number of assumptions embedded in the models presented here are restrictive in the present context, but they need not imply loss of generality for the results reported. The first of these assumptions concerns the specific tessellation structure chosen—the structure of the lattice. Hexagonal and triangular arrays are less commonly used than square lattices, but they are equally plausible (Gutowitz & Victor, 1989).

The second such assumption concerns the specific rules of local interaction that we selected. As we mentioned, the dynamics of organizational populations can be simulated under a vast number of evolutionary conditions and rules of local interaction. On the one hand, this possibility makes the modeling framework extremely flexible but, on the other hand, it makes the choice of any particular set look, arbitrary. This situation reflects, in part, the fact that received ecological theories of organizations are extremely vague about the role of individual action. As a consequence, our model specification suffers from a lack of theoretical guidance, or established empirical results on microprocesses. The models presented are not, however, inconsistent with theories of rational action according to which potential entrepreneurs form expectations about the future profitability of their ventures on the basis of the information contained in organizational vital rates and population density (Aldrich & Fiol, 1994; Hannan & Carroll, 1992).

The final set of limitations is related to the deterministic nature of the models. The models simulated here contain no random component, and its absence could attract allegations of lack of realism. Random perturbations are easy to incorporate in our models in several ways. For example, a stochastic time-varying component could be added to Λ (the founding threshold), or to $E_u - E_l$ (the survival band). In previous work (Lomi & Larsen, 1995), we implemented a similar solution in the context of a one-dimensional model of voting behavior by drawing a random quantity from a uniform distribution, adding it to the underlying rule for local interaction, and then using the new time-varying rule to update the state of each cell of the lattice in each time period. In the present context, we limited our attention to deterministic models because we wanted to show that simple rules of local interaction are capable of producing a wide range of population-level behaviors even in the absence of any random disturbance.

Many of the limitations discussed can be alleviated simply by providing individual cellular "agents" with additional intelligence, foresight, memory, or—in general—computational power and then studying the aggregate evolutionary dynamics of populations composed of organizations capable of various degrees of rational calculus. This can be done, for example, by designating individual organizations as players in an iterated game with their neighbors in which the state transitions are determined by the structure of a payoff matrix (Lomi & Larsen, 1997). This modeling strategy requires the development of an explicit theory of action at the organizational level, the lack of which has been claimed to be a major hurdle for the future development of ecological theories of organizations (Hedstrom, 1992). The development of a microlevel theory of action informed by current theories of organizations, and analytically tractable in our modeling framework, is the natural next step in this research. The present work is nothing more than a first attempt to build the link between the interdependent actions of local strategists and the evolution of organizational populations, or in other words, between action and structure and actors and systems.

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ORGANIZATIONAL EVOLUTION, LEARNING, AND SELECTION: A GENETIC-ALGORITHM-BASED MODEL

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This study proposes a relatively simple computational model of organizational evolution based on the genetic algorithm. The model includes three organizational processes: variation, adaptation, and selection of routines. We use the model to demonstrate theoretically that environmental selection influences adaptation and adaptation, in turn, influences the selection process in a Darwinian model of evolution. Results of computer simulations are consistent with empirical observations, including the existence of three distinct phases of organizational evolution and the emergence of a dominant organizational design.

A central debate around the evolution of organizational forms has been fueled by two competing perspectives on change. According to the environmental selection perspective, organizations are inert and selection of entire firms is responsible for major adaptations to business environments (Hannan & Freeman, 1977, 1989). In contrast, advocates of the adaptation perspective propose that organizations are flexible and adapt to their environments by changing their routines and standard operating procedures (Cyert & March, 1963; Levitt & March, 1988). To reconcile the two models of organizational change, Scott (1987), Singh, House, and Tucker (1986), and Astley and Van de Ven (1983), among others, have argued that adaptation and environmental selection are not conflicting perspectives but complementary, though they typically focus on different levels of analysis and organizational features (core or peripheral). Levinthal (1991) proposed a different synthesis, arguing that learning and selection are fundamentally interdependent pro-

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cesses because adaptation enhances inertia, even as inertia accelerates the process of environmental selection.

This research builds on Levinthal's (1991) argument by proposing that organizational learning guides and accelerates the process of organizational evolution.[1] In our framework, we interpret the capacity for organizational learning as a "genetic" trait that is itself subject to Darwinian selection. A population of organizational forms that is capable of learning will discover a viable organizational form much more quickly than a population of their inert counterparts. This is true in spite of the selection process being strictly Darwinian: even when acquired traits are not heritable, selection will favor the capacity to acquire traits.

The proposed computational model serves two purposes. First, it suggests that three fundamental processes constitute integral aspects of organizational evolution. These processes are (1) variation, or the birth of organizational forms as a carrying out of new combinations (Lumsden & Singh, 1990; Schumpeter, 1934; Van de Ven & Grazman, 1994); (2) organizational learning as an example of adaptation (Cyert & March, 1963; Levitt & March, 1988); and (3) selection, that is the death rates of organizational forms proportional to their relative fitness (Hannan & Freeman, 1977, 1989). Second, the model is used to demonstrate theoretically that organizational learning and environmental selection are fundamentally interdependent processes even in a Darwinian framework of evolution. Specifically, we assert that environmental selection influences organizational learning capabilities, learning capabilities, in turn, influence selection processes.

There has been a long tradition of using computer simulation to understand organizational decision making (e.g., Cohen, March, & Olsen, 1972; Cyert & March, 1963), how individual organizations learn (e.g., Herriott, Levinthal, & March, 1985; Levinthal & March, 1981; Lounamaa & March, 1987; Morecroft, 1985), and how populations of organizations evolve (e.g., Lant & Mezias, 1990, 1992; Mezias & Lant, 1994; Nelson & Winter, 1982). Our model has both similarities to and differences with these earlier modeling approaches. The two major similarities are (1) modeling several individual organizations to understand the dynamics of organizational evolution at the population level (e.g., Lant & Mezias, 1990; Mezias & Lant, 1994) and (2) modeling individual firms as sets of routines (e.g., Mezias & Glynn, 1993; Nelson & Winter, 1982). A novelty of our approach is that we explicitly model Schumpeter's (1934) idea of entrepreneurial innovation as a recombination of previous organizational forms. This idea is consistent with recent empirical evidence documenting how health care organizations evolved over time by recombining existing organizational units and internal resources (Van de Ven & Grazman, 1994). Another major difference between our model and previous approaches is that we do not model organizational aspiration levels (Cyert & March, 1963; Lant, 1992; Lant & Mezias, 1990, 1992; Levinthal & March, 1981; March, 1988; Singh, 1986). To keep our model simple, we assumed here that entrepreneurs are always searching to improve an organizational form.

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[1] This notion is consistent with the idea of an "ecology of learning" whereby organization level change is guided by experiential learning (e.g., Mezias & Lant, 1994).

Our main purpose in this research was to argue theoretically that organizational learning guides environmental selection in a Darwinian framework of evolution. We posit three fundamental processes of organizational evolution—variation, adaptation, and selection. Thus, our objective was to build theory rather than construct a descriptively accurate model of organizational evolution. In this sense we follow in the tradition of simple computer models of basic organizational processes such as the "garbage can" model (Cohen, March, & Olsen, 1972) and the "exploration versus exploitation" model (March, 1991). However, we believe that this simple model can provide a useful platform for future refinements that will embody greater realism. In this spirit, we outline in the final section how the current computer simulation can be adapted to create a more descriptive model of organizational evolution.

The interdependence between learning capability and Darwinian selection is not a new idea. It was first proposed a century ago by two biologists (Baldwin, 1896; Morgan, 1896) and has recently been rediscovered by Hinton and Nowlan (1987) and Belew (1990). Both Baldwin and Morgan proposed that in the case of biotic evolution, only some of the inherited traits are genetically fixed; others are unspecified and must be learned during an organism's lifetime. Organisms that inherit poor unspecified traits—that is, poor learning capabilities—will not survive the evolutionary race. In contrast, organisms that inherit good unspecified traits will be able to learn traits crucial for survival. Thus, organisms that inherit useful learning capabilities will spread rapidly through the population, guiding Darwinian selection to the regions of increased fitness.

Simon proposed a variation of the above argument to explain the existence of altruism. He argued that it is difficult to account for true altruism, defined as behavior that reduces the fitness of the altruist but increases average fitness in society. He proposed this instead:

> a simple and robust mechanism, based on human docility and bounded rationality, that can account for the evolutionary success of genuinely altruistic behavior. Because docility—receptivity to social influence—contributes greatly to fitness in the human species, it will be positively selected. As a consequence, society can impose a "tax" on the gross benefits gained by individuals from docility by inducing docile individuals to engage in altruistic behaviors. Limits on rationality in the face of environmental complexity prevent the individual from avoiding the "tax" (Simon, 1990: 1665).

In Simon's framework, specific learning capabilities, such as docility, lead to an evolutionary advantage and will be positively selected over time.

ORGANIZATIONAL FORMS AND FITNESS LANDSCAPES

Organizational forms are defined here by firm strategy and structure (Chandler, 1962; Hannan & Freeman, 1977, 1989). This definition is built upon the organizational genetics perspective (McKelvey, 1982; Nelson & Winter, 1982), wherein routines are interpreted as the genes of an organization. Nelson and Winter defined a routine as follows:

> Our general term for all regular and predictable behavioral patterns of firms is a "routine." We use this term to include characteristics of firms that range from well-specified technical routines for producing things, through procedures for hiring and firing, ordering new inventory, or stepping up production of items in high demand, to policies regarding investment, research and development (R&D), or advertising, and business strategies about product diversification and overseas investment (1982: 14).

From this broad definition, we infer that a set of high-level routines can describe the strategy and structure of a firm. Thus, our operating premise is that we can approximate organizational forms by sets of key strategic routines. This approach is consistent with those applied in other computer models of organizational evolution (Cohen, 1981; Lant & Mezias, 1990, 1992; Mezias & Glynn, 1993).

Within our model, an organization is highly successful only if all key strategy routines exactly match environmental demands. This assumption is a deliberately stark simplification of reality and designed primarily to demonstrate the extent to which organizational learning can guide environmental selection.[2] The above definition of organizational fitness can be visualized as a flat fitness landscape with a single "spike." The spike marks the unique, correct, organizational form that fits the particular organizational environment perfectly.[3] Figure 1a is a one-dimensional representation of such a fitness landscape. The horizontal axis displays all possible organizational forms. The vertical axis displays their corresponding fitnesses.

Fitness landscapes were first proposed by Wright (1932) and have been more recently introduced to the social sciences (e.g., Ahouse, Bruderer, Gelover-Santiago, Konno, Lazer, & Veretnik, 1992; Bruderer, 1993; Levinthal, 1994; McPherson, 1990). Organizational fitness landscapes are a useful metaphor for describing the dynamics of organizational evolution. Here a population of individual organizational forms is seen as moving on a

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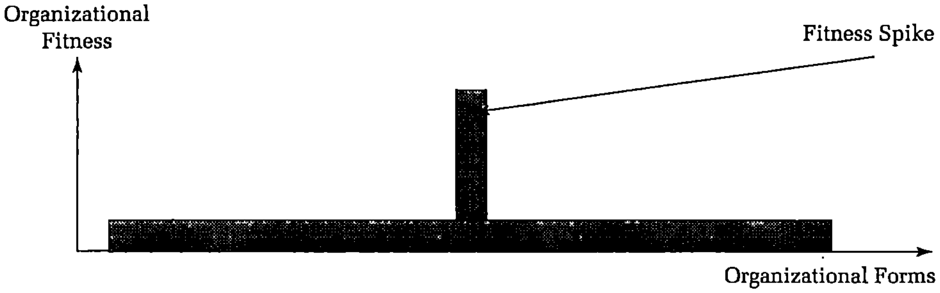
[2] In economics and political science, for example, it is common to construct simplified models of reality to investigate theoretical issues (e.g., social dilemma games such as the prisoner's dilemma). Rasmusen (1989) coined the term "no-fat models" and argued that, though these models do not describe reality, they can clarify important theoretical issues.

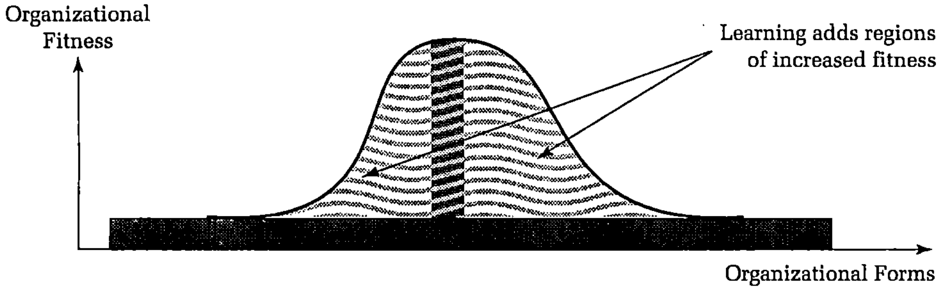
[3] It is worth noting that the assumption of a single fitness spike may violate "equifinality" (Katz & Kahn, 1978). Our model can be extended to include equifinality by allowing multiple fitness spikes on the fitness landscape. Such an extension would not change the basic implications of our model because learning would still guide selection. However, it would make our exposition considerably more complex and, possibly, less clear.

FIGURE 1

(a) Spikelike Fitness Landscape



(b) Hill-like Fitness Landscape



fitness landscape of possible forms where firms closer to the hilltop have a higher fitness. In this framework, organizations adapt to their environments myopically by "climbing" uphill (Levinthal & March, 1993; Levitt & March, 1988; Lounamaa & March, 1987) rather than by improving their positions through a process of rational intention.[4]

A flat fitness landscape with a single spike is the most demanding case for an evolutionary search because it contains no organizational forms of intermediate fitness that can guide the evolutionary process. Thus, an evolutionary search can only be a random exploration among all possible combinations of organizational forms. To use another metaphor, searching for improved fit in such a spikelike fitness landscape is similar to trying to find a needle in a haystack (Hinton & Nowlan, 1987).

Baldwin's (1896) and Morgan's (1896) ideas about how learning guides evolution are crucial, we believe, to the understanding of how a population of organizational forms searches difficult, spikelike fitness landscapes. A key argument is that an evolutionary process is more effective if new organizational forms inherit only some fixed routines from previously successful organizations, while letting others remain open to organizational learning. This openness allows firms to initially choose some of their key routines incorrectly. Because those routines can be changed later, the organization may eventually discover the correct form. Thus, organizational learning constructs a region of increased fitness around the fitness spike, transforming it into a gentler hill.[5] A hill can be searched more effectively by an evolutionary process because the process is constantly guided toward the top of the hill, where fitness is greatest (Figure 1b). To return to the needle-in-the-haystack metaphor, it is like trying to find a needle in a haystack with continual feedback provided about whether one is getting closer (Hinton & Nowlan, 1987).

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[4] In response to an anonymous reviewer, we want to emphasize that fitness landscapes differ from fitness functions of individual organizations (e.g., Lounamaa & March, 1987). Fitness landscapes are intended to illustrate the dynamics of an entire organizational population and not only those of individual organizations. For example, fitness landscapes can be used to depict how the U.S. car industry fell into a "competency trap" (Levitt & March, 1988) during the 1970s and early 1980s because it got stuck on the local performance hill of producing large cars for the U.S. market.

THE GENETIC ALGORITHM

The proposed model of organizational evolution is based on the genetic algorithm (Goldberg, 1989; Holland, 1992). The genetic algorithm borrows certain ideas from biological evolution to simulate intelligent adaptation in natural and artificial systems. These ideas are (1) variation through crossover, (2) variation through mutation, and (3) selection proportional to fitness. For both variation and selection parallels can be drawn to organizational processes of social evolution (Campbell, 1969; Nelson & Winter, 1982; Weick, 1979). Variation through crossover is analogous to innovation defined as recombination or a new combination of existing routines (Kogut & Zander, 1992; Lumsden & Singh, 1990; Schumpeter, 1934; Van de Ven & Grazman, 1994). Variation through mutation parallels playful experimentation (Levitt & March, 1988) and incorrect transmission of routines (Nelson & Winter, 1982). Selection proportional to fitness is analogous to Darwinian selection of organizational forms (Hannan & Freeman, 1977, 1989).

The genetic algorithm can be used to represent organizational forms as abstract symbol strings in which each symbol stands for a particular choice of routine. To simulate the process of organizational evolution, a starting population of symbol strings is assumed, each representing an individual organizational form. New organizational forms are created from previously successful organizational forms, mainly through recombination (crossover) of existing forms. This evolutionary process ensures (1) rapid spread of routines from highly fit organizational forms through the population and (2) innovation of organizational forms by the creation of plausible new combinations from previously successful forms. Exhibit 1 summarizes the genetic algorithm, using the problem context of organizational evolution.

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[5] When organizational learning is absent, the fitness of near-misses compared to that of the correct organizational form is significantly lower; hence the spikelike shape of the fitness landscape. Organizational learning transforms a fitness landscape from spikelike to hill-like because organizational forms that are near-misses are almost as fit as their correct counterparts since they can easily become the correct organizational form through learning. This is not possible in inert, unchanging organizations.

The basic principles of the genetic algorithm can be understood intuitively. If an organizational form is highly fit—for example, twice as fit as the average member of the population—this form will be twice as likely to be chosen as a "mate" to create a new combination of a firm. Thus, routines that contribute to a high fitness level in an organizational form spread rapidly through a population (Holland, 1992). The genetic operator, crossover, effectively creates plausible new organizational forms because they are combinations of previously successful organizational building blocks.

The genetic operator, mutation, which infrequently and randomly changes some information, can reinstall useful information that has been lost or never was present in the initial population of organizational forms. Mutation is important if a given population is small (relative to the number of routines) or if the population faces a continuously changing environment, because mutation can prevent premature convergence toward an inferior organizational design. In those cases, mutation plays the role of shifting an evolutionary search from exploiting existing routines toward exploring new routines (Holland, 1992; Levinthal & March, 1993; March, 1991).

Abstract representation of organizational forms as symbol strings is a major strength of the genetic algorithm. It allows theoretical investigation of

EXHIBIT 1
Major Steps of the Genetic Algorithm

Step 1 Choose an initial population of organizational forms.

Step 2 Define an organizational fitness function.

Step 3 Evaluate each organizational form according to the fitness function.

Step 4 Create a new population of organizational forms from members of the previous population by repeating the following two steps until the new population reaches the same size as the old population.

> **Step 4.1** Randomly choose two parent organizational forms from the previous population proportional to their organizational fitness.
>
> **Step 4.2** Apply the genetic operators of crossovers and mutation to the parent to create two child organizational forms for the new population.

Step 5 If a previously specified number of populations has been created, stop the algorithm; otherwise, go to step 4.

important aspects of organizational evolution using computer simulation and mathematical analysis. Such an abstract analysis is possible as long as two conditions are fulfilled: (1) the symbol string representation is meaningful and (2) an appropriate organizational fitness function can be defined.

Fulfilling the first condition is a nontrivial exercise. Theoretically, construction of a symbol string is always possible, but actual implementation can cause difficulties. The creation of new organizational forms can be socially wasteful because the genetic algorithm does not automatically prevent the creation of nonsensical forms, such as a form with two (duplicate) marketing departments. Wastefulness can be avoided if specific segments of the representation of an organization are designated to specific parts of an organizational form. For example, the first four routines could represent the marketing department, and the next four routines could designate the finance department.

The second condition demands that an appropriate organizational fitness function be defined. The genetic algorithm poses no restrictions in this respect. A fitness function can even be defined contingent on the states of other forms, which would, for example, cover the interesting case of coevolving organizational populations (Ahouse et al., 1992). A major challenge is to define organizational fitness functions that are empirically meaningful.

A COMPUTATIONAL MODEL OF ORGANIZATIONAL EVOLUTION

Our computational model[6] implements three interdependent processes of organizational evolution: (1) variation of the creation of novel organizational forms, (2) organizational learning as an example of adaptation, and (3) selection—the death of organizational forms. This model is based on Hinton and Nowlan's (1987) adaptation of the genetic algorithm (Holland, 1992). Departing from the standard genetic algorithm described in the previous section, we have added organizational learning to the model of organizational evolution and deleted mutation.[7] A major novelty of our approach is that we explicitly model how entrepreneurs engage in organizational innovation by recombining routines in novel ways from successful existing forms. In contrast, previous models have rested on the assumption that entire new organizational forms are imitated at a rate proportional to their frequency in the population (cf. Lant & Mezias, 1990, 1992).

The computer model's first assumption is that the organizational form determines the macrobehavior of an organization and that such behavior can be represented as a set of routines. This assumption follows a tradition of successfully modeling organizational behavior as a set of routines and standard operating procedures (Cohen, 1981; Cohen, March, & Olsen, 1972; Cyert & March, 1963; Lant & Mezias, 1990, 1992; Mezias & Glynn, 1993; Mezias & Lant, 1994). In this model, it is only necessary to consider routines that are inexpensive to change relative to the costs of founding new organizational forms. Routines that are expensive to change can be selected more effectively through foundings.

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[6] The computer code (written in Think Pascal for the Macintosh) is available from the authors for the purpose of replication only. Such requests can be directed to either author. Per this journal's policy, the requester would be responsible for any costs incurred by the authors.

[7] In our sensitivity analyses, we ran the model with mutation and found that the outcomes were not significantly affected. With mutation, the discovery of the first viable form typically is unchanged because the population size is large enough to incorporate the necessary genetic variety in the initial population.

The expense of changing routines should be addressed. First, routines that involve sunk costs are often expensive to change. Such expenses might include investment in learning a particular set of routines—for example, operating an integrated manufacturing system for the production of a specific microprocessor. Second, routines that are highly interconnected are expensive to change because they require adjustments in other routines. Changing a single routine in a highly interconnected organization could result in an avalanche of expensive changes throughout the organization. For example, changing a key accounting procedure might demand expensive administrative adjustments in many parts of a firm. Third, routines that take much time to learn are expensive to change, even if the learning process itself is cheap. An example may be building the absorptive capacity for a new technology (Cohen & Levinthal, 1990).

An organizational form is implemented in our computer model as a sequence of 20 routines,[8] with each routine represented by three possibilities: 0, 1, and ? (Figure 2a). If a routine takes the value of 1, it is correctly specified by the organizational form (according to the chosen fitness function); if it takes the value of 0, it is incorrectly specified. If a routine is represented by a ?, it is unknown and must be discovered through organizational learning. For example, a firm can either chose one of two particular accounting systems (modeled as a 0 or 1), or it can leave the choice of accounting system open to learning (modeled as a ?), which can be interpreted as the firm's subcontracting this function to another company. According to this implementation, the unique, correct organizational form is defined as "11 . . . 1," a sequence in which all 20 routines are set to 1 because no successful routine is missed.

The second major assumption is that organizational learning can be modeled as a random search among "undecided" routines, or routines that are not yet fixed. A random search is a realistic first approximation to organizational learning. For example, as Hannan and Freeman stated:

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[8] An anonymous reviewer asked why we did not choose a smaller number of routines. If the number of routines is quite small, then the effect of organizational learning on environmental selection is not very strong. For example, if there is only one routine, then by chance alone an organization is likely to find the correct routine, and learning does not add much value. But as the number of routines increases, the search space quickly becomes very large and the time needed to run the simulations grows nonlinearly, although learning clearly helps more in this situation. Thus, the current 20-routine model represents a compromise choice, although the number itself is arbitrary.

> A growing number of organizational theorists and researchers argue that much organizational change is largely uncontrolled and that the consequences of designed structural changes are difficult to anticipate. If this is so, organizations staffed by rational planners may behave essentially randomly with respect to adaptation (1989: 23).

Furthermore, random learning provides a lower bound of the interaction between organizational learning and environmental selection because most other processes of intelligent learning presumably guide and thus accelerate evolution even more, by increasing the probability of discovering better organizational forms.

Organizational learning was implemented as N random learning trials during the lifetime of an organizational form, where N is arbitrarily fixed to 1,000. A single organizational learning trial is equivalent to tossing an unbiased coin k times, where k is specified by the number of undecided routines. For example, if an organizational form consists of 11 correct routines and 9 undecided routines (organizational form number 1 in Figure 2b), then a single organizational learning trial consists of tossing an unbiased coin 9 times. If the coin comes up 1 nine times, the correct organization has been discovered and the correct organizational form is frozen. Otherwise the original organizational form with 9 undecided routines is restored and a new learning trial begins.

The third assumption concerns the shape of the organizational fitness function $f(t)$, where t defines at which time (i.e., at which trial) the correct organizational form was discovered (see Figure 3). The fitness function $f(t)$ is assumed to be

$$f(t) = \begin{cases} c_0 & \text{if "11 \dots 1" was never discovered} \\ c_1 - c_2\left(\dfrac{t}{N}\right) & \text{if "11 \dots 1" was discovered between } 0 \le t \le N. \end{cases} \tag{1}$$

We chose the values $c_0 = 1$, $c_1 = 20$, $c_2 = 10$, and $N = 1{,}000$ and chose the fitness function and parameters on the basis of the following reasoning: If an organization has ever discovered the correct organizational form (11 . . . 1), it will be 10 times as fit as an organization that never discovered it. If an organization discovers the correct organizational form very early, it obtains a fitness close to 20 ($=c_1$), but an organization that discovered it late only obtains a fitness close to 10 ($=c_2$). In other words, the shape of this fitness function penalizes learning in proportion to how long discovery of the correct organizational form takes. For example, in Figure 2b, organizational form number 3 discovered "11 . . . 1" earlier than number 1. Thus, organizational form 3 is assigned the fitness value of 17.9, which is higher than the fitness value of 14.5 form of 1. The chosen fitness function is intuitive, and

FIGURE 2

(a) The Population of Organizational Forms in the 1st Generation

Number	Organizational Form	Fitness
(1)	???11110?00??001?010	1.0000
(2)	????????0?1??0???000	1.0000
(3)	???0??110?0?0??1101?	1.0000
. . .	. . . . . .	
(248)	???1?0?????1?1?1?10?	1.0000
(249)	?1????00?1101?1??1??	1.0000
(250)	?0???1?110??101?0011	1.0000

(b) The Population of Organizational Forms in the 11th Generation

Number	Organizational Form	Fitness
(1)	11?1111??1?1?1????1	14.4500
(2)	1??1111??11?111?1??1	16.3000
(3)	11?1111??1?1?1????1	17.9100
. . .	. . . . . .	
(248)	11?1111??1?1?1????1	13.1400
(249)	11?1111??1?1?1????	1.0000
(250)	?1?1111??11?111?1??1	19.5700

(c$_1$) Parent Organizational Forms

(1) ???11110?00??001?010

(2) ????????0?1??0???000

(c$_2$) Child Organizational Forms

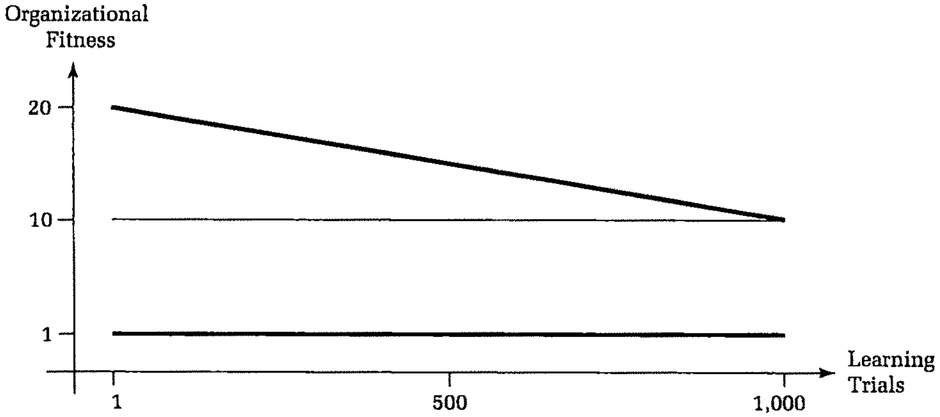
(1) ???11???0?1??0???000

(2) ?????110?00??001?010

changes in the parameters will not influence the results qualitatively as long as the relative order of parameter values $c_0 < c_2 < c_1$ holds.

The above fitness function is also based on the assumption that organizational fitness is monotonic, or nondeceptive. The higher the number of correctly specified routines, the higher the fitness. This assumption may not always be true in real environments, where there may be organizational forms in which specific combinations of routines yield higher fitness because they interact positively, but each correctly specified routine on its own

FIGURE 3
Shape of Fitness Function



leads to lower fitness. However, this specification provides a reasonable starting point.

The fourth major assumption is that the creation of organizational forms is modeled as a recombination of existing forms (Schumpeter, 1934). Figure 2c demonstrates how two "child" organizational forms can be created through recombination (crossover) from two "parent" organizational forms. The assumption that a child inherits routines from just two parents is restricting but does not significantly influence the theoretical conclusions. In choosing a single crossover instead of multiple crossover[9] and inheritance from two parents instead of multiple parents, we sought to keep our model as simple as possible but still able to theoretically demonstrate our main argument, that organizational learning guides environmental selection. As mentioned earlier, this assumption is consistent with recent empirical evidence documenting how health care organizations evolved over time by recombining existing organizational units and internal resources (Van de Ven & Grazman, 1994).

Genetic transmission of organizational routines happens when (1) a new organization is created, (2) parts of other organizational forms are imitated (DiMaggio & Powell, 1983; Nelson & Winter, 1982), or (3) parts of a company are acquired or divested (Winter, 1990).

Combinations of previously successful forms follow Schumpeter's view of innovation. For Schumpeter, innovation was a "carrying out of new combinations" (1934: 66) and clearly extends to "the carrying out of the new organization of any industry" (1934: 66). As can be verified by a simple example within the framework of this model, any possible organizational form can be generated from previously existing organizational forms, as long as possible routines are present at least once in the population of organizational forms.[10]

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[9] Davis (1991: Ch. 3) discusses advantages and disadvantages of different crossover methods, such as two-point crossover and uniform crossover.

The computer model described above was implemented following steps 1 and 2 of the genetic algorithm (Exhibit 1). The initial population of 250 organizational foundings, called the first generation, was randomly generated using the following probabilities: $p_\alpha = .25$ for either 0 or 1 and $p_\beta = .5$ for ?. These probabilities mean that, in the first generation, about half the routines of an organizational form are undecided, one-quarter are correctly chosen, and one-quarter are incorrectly chosen. It should be noted that in each new generation, new organizational forms replace all 250 organizational forms. This simplification is adequate for the purpose of demonstrating how organizational learning guides environmental selection in a Darwinian framework of evolution. For other applications our model can be changed by replacing only the lowest-performing forms and retaining those performing better (Lant & Mezias, 1990, 1992).

RESULTS

The computational model of organizational evolution is used here to investigate theoretically whether organizational learning can accelerate the discovery of useful new organizational forms. We first performed computer simulations that included organizational learning. We then compared those simulations to a model of organizational evolution that did not include organizational learning.

Figure 4a summarizes the results of a typical computer simulation that included organizational learning.[11] The three curves show the relative frequencies of correct, incorrect, and undecided routines over time (generations). To explain how organizational learning accelerates the process of environmental selection, some brief calculations are necessary. The raw output of the computer simulation shows that the first viable organization (that is, an organization that is able to discover the correct organizational form "11 . . . 1" during its lifetime) was discovered in the seventh generation. The total number of foundings of organizational forms, therefore, is 1,750 (7 × 250), since there are 250 foundings for each generation. To confirm this finding with a different method, we derived a mathematical solution for the expected waiting time (see the Appendix). On the basis of two calculations, we

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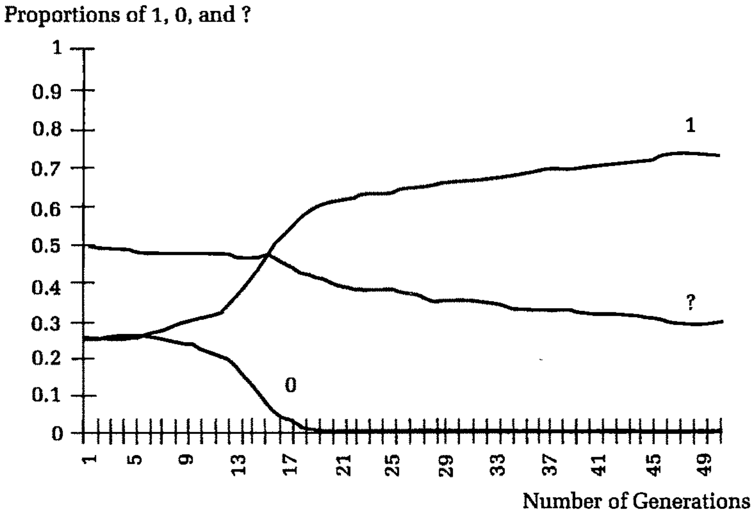
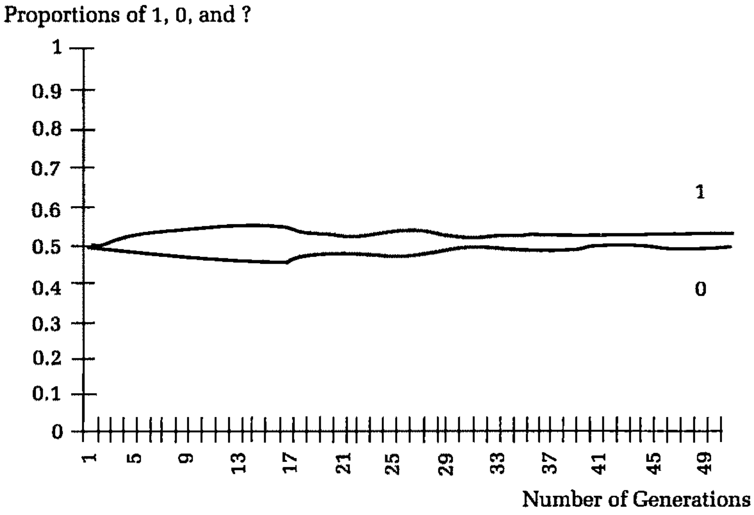
[10] Let us imagine three organizations with three routines: organization 1 as 01?, organization 2 as ?01, and organization 3 as 1?0. Since all three possibilities are present for all three routines, any potential organizational form can be constructed from these three basic forms through crossover. For example, an organization 111 could be generated by first crossing organization 1 and 2 after the second routine to obtain organization 011, which then could be crossed with organization 3 after the first routine to obtain organization 111.

[11] The reported simulation is the median of ten computer runs conducted to determine when the first viable organizational form was discovered. All reported findings were present in all ten computer runs with some minor variations.

FIGURE 4
Relative Frequencies of Routines: Spikelike Fitness Landscape
(a) Population of 250 Learning Organizations



(b) Population of 250 Inert Organizations



determined that an average 1,793 foundings are needed to discover a viable organizational form. This number is quite close to the number of 1,750 foundings from the computer simulation, which strengthens our confidence.

It is informative to compare this number (1,750) of foundings to the expected total number of foundings of inert organizational forms (organizational forms that do not include organizational learning) needed to discover the first viable organizational form. As mentioned above, the process of organizational evolution in a spikelike fitness landscape is equivalent to a random search among inert organizational forms. Thus, the question becomes, What is the expected waiting time (t_w, the average time that would elapse) needed to discover 20 correct routines in a row? The answer is 1,048,576 (2^{20}) foundings of organizational forms, since there are two possibilities (0 and 1) for each of the 20 routines; this corresponds to about 4,194 generations. Figure 4b shows that, as may have been expected, a population of inert forms did not discover a viable form within 50 generations.

This result supports the main argument of this article—that inexpensive organizational learning trials significantly accelerate the discovery of a viable organizational form. Within this model, organizational learning accelerated environmental selection by about 600 times (1,048,576 ÷ 1,750). This amount of acceleration is surprising considering that learned routines are not directly transmitted from one generation to the next, as would happen in a Lamarckian process of evolution.

From the above results, it is possible to estimate how inexpensive an organizational learning trial should be relative to the cost of an organizational founding in order for a learning population to be more cost effective than a population of inert forms. If a learning trial costs x times more than an organizational founding, the following inequality must hold for organizational learning to be more economical:

$$(1{,}750{,}000\ x) + 1{,}750 \leq 2^{20}. \tag{2}$$

The left-hand side of the inequality represents the total cost of a population of learning organizational forms, and the right-hand side represents the total cost of their inert counterparts. The number 1,750,000 reflects the total number of learning trials (1,750 organizational foundings times 1,000 learning trials for each founding). Solving Inequality 2 for x, we obtain $x \leq 0.60$. In this particular model, organizational learning yields an evolutionary advantage as long as a learning trial costs less than about 60 percent of the cost of a founding.

Although a spikelike fitness landscape best demonstrates how organizational learning guides environmental selection in a Darwinian framework of evolution, a question arises: What would happen if the landscape were more hill-like?[12] A strength of computer simulation methodology is that we could change the above model to investigate this particular question. We could guess a priori that a hill-like landscape already guided evolution. Thus, we expected that the more hill-like the landscape, the less organizational learning would help discovery of the first viable organizational form; the added advantages of organizational learning would be smaller.

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[12] We are grateful to an anonymous reviewer for suggesting this question.

We conducted several computer simulations with different hill shapes. It should be noted that in a hill-like landscape, missing one or more routines will not be punished as harshly as it will in a spikelike fitness landscape. For example, if the hill has a base of 5, missing up to 4 routines still yields some additional fitness. Figures 5a and 5b show that in this case the advantage of learning disappears—a viable organizational form is discovered in the first generation, whether organizational learning is present or not. Figure 5b shows that if the organizational fitness landscape is more hill-like, a population of inert forms adapts better to the environment. This finding is consistent with Hannan and Freeman's (1984) argument that inertia itself can lead to an evolutionary advantage over time.[13]

In addition to running the model with different fitness landscapes, we performed a sensitivity analysis on several of the model parameters, including different population sizes and fitness functions. In all those simulations, our main result—that organizational learning accelerates the discovery of the first viable form—was not significantly altered.[14,15] We also ran the model with a different method of varying routines. Instead of creating novel organizational forms as recombinations of existing forms (Schumpeter, 1934), termed the *Schumpeterian* mode of variation, we assumed that entrepreneurs imitated entire organizational forms (DiMaggio & Powell, 1983; Lant & Mezias, 1990, 1992; Mezias & Lant, 1994), modifying them slightly (Hannan & Freeman, 1989). We termed this the *mimetic* or *DiMaggio and Powell* variation mode. Figures 6a and 6b each show a typical computer simulation with one of the two different modes of varying routines. In this case, the fitness landscape is a hill with base 2, where an organizational form with one routine missing still yields additional fitness. As may have been expected, this different model of variation did not much change our main results since it does not improve the search for and discovery of the first viable form, though it does increase the realism of our model to some extent. However, this latter mimetic model of transmission has an impact on incremental organizational improvement; it does not adapt as well to the environment as the Schumpeterian transmission mode.

The main result of the computer simulations is that organizational learning significantly shortens the waiting time before the discovery of a first

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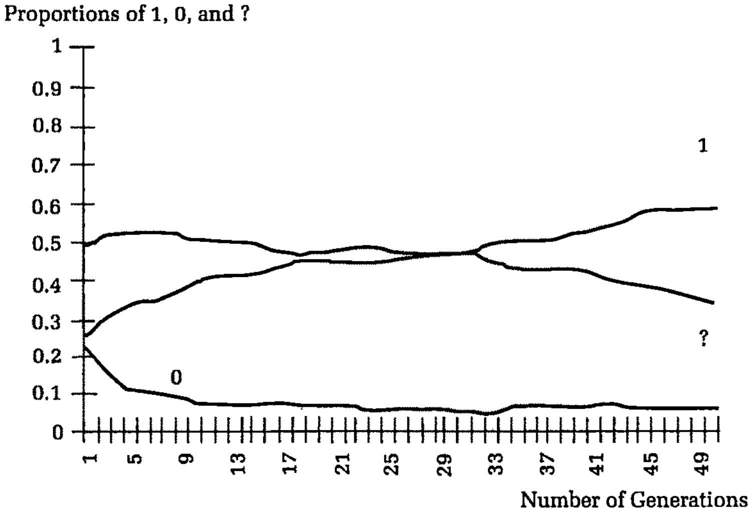
[13] Contrary to the above, some recent evidence (Barron, West, & Hannan, 1994) suggests that older organizations have higher failure rates, a kind of liability of obsolescence. We are grateful to an anonymous reviewer for pointing out this caveat. We believe that this issue may be further illuminated by contrasting static fitness landscapes with dynamically changing fitness landscapes. However, a resolution of this question is beyond the scope of the current article.

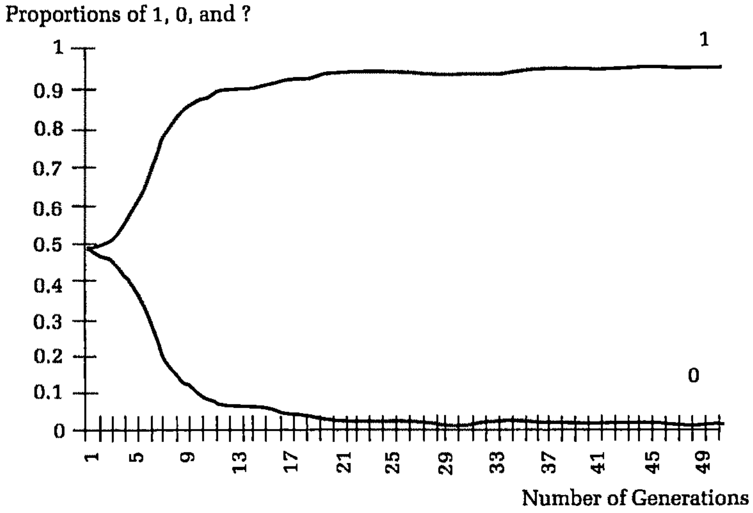
[14] With population sizes of 50, 100, and 250, our main results were not influenced. Only if a population is very small is there a significant change in results, because very small populations lack the genetic diversity to engage in an effective search for new, fitter forms.

[15] As expected, variation of the fitness function (Equation 1 and Figure 3) did not affect the discovery of the first viable form because the fitness function does not influence the search process until a viable form is discovered.

FIGURE 5
Relative Frequencies of Routines: Hill-like Fitness Landscape with Base 5
(a) Population of 250 Learning Organizations

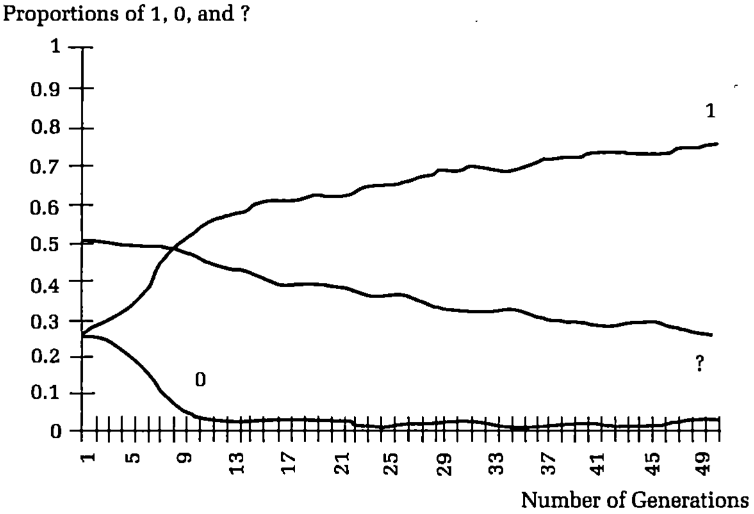


(b) Population of 250 Inert Organizations

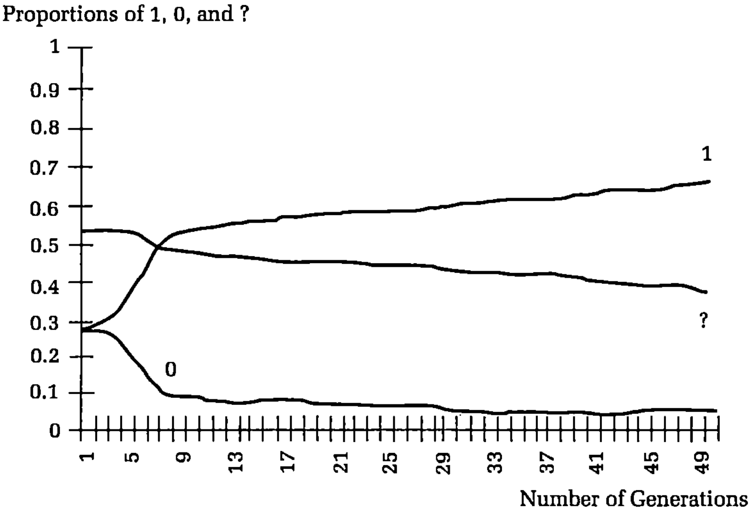


viable organizational form but only does so if the underlying organizational fitness landscape is spikelike. In a hill-like fitness landscape, inert organizational forms will not only discover a viable form as quickly as their learning counterparts but will also adapt better to the environment; the entire population will have higher fitness values.

FIGURE 6
Relative Frequencies of Routines in a Population of 250 Learning Organizations: Hill-like Fitness Landscape with Base 2
(a) Schumpeterian Model of Routine Variation



(b) DiMaggio and Powell Model of Routine Variation



DISCUSSION

Links to Empirical Observations

Results from our simple computer model are consistent with observations that have been made separately in other research. These results of the computational model are neither obvious from the assumptions nor likely to be chance events. Thus, these results add some confidence to our belief that the proposed model captures some important aspects of organizational evolution.

The first result concerns Stinchcombe's observation that "Organizational types generally originate rapidly in a relatively short historical period, to grow and change slowly after that period. The time at which this period of rapid growth took place is highly correlated with the present characteristics of organizations of the type" (1965: 168). The results of the computer simulations show that, once the first viable organizational form has been discovered in generation 7 (see Figure 4a) it spreads rapidly through the entire population of organizational forms, establishing itself as the dominant organizational design by generation 11 (also see Figure 2b). All further incremental improvements are then based on that dominant design.

The second result concerns the three distinct phases of organizational evolution (Figure 4a): (1) organizational experimentation (generations 1 to 6), (2) organizational revolution and the establishment of a dominant organizational design (generations 7 to 11), and (3) incremental organizational improvement (generations 12 to 50). These three distinct phases have been studied empirically for the special case of technological evolution (Tushman & Anderson, 1986; Utterback & Abernathy, 1975). Technological evolution may, we believe, be seen as a special case of organizational evolution, because technological know-how can usefully be interpreted as a set of technological routines or core competencies (Nelson & Winter, 1982; Prahalad & Hamel, 1990).

The third result concerns increases in structural inertia over time. As Hannan and Freeman (1984) pointed out, the nature of selection processes itself is such that inertia can increase over time. Drawing upon this earlier work, Singh, Tucker, and Meinhard (1988) developed a "rigidity of aging" argument, according to which rates of change in organizations decline with age. Those authors found some supportive empirical evidence from voluntary social service organizations. Some other empirical support comes from studies of newspapers in Finland (Amburgey, Kelly, & Barnett, 1993; Miner, Amburgey, & Stearns, 1990), U.S. airlines (Kelly & Amburgey, 1991), and U.S. credit unions (Amburgey & Dacin, 1993). Our model reflects this empirical evidence because the percentage of flexible routines (?s) within the population decreases over time, but the number of fixed, correct routines (1s) increases (see, for example, Figure 4a). This is the case because organizational forms with all 20 routines correctly fixed have a higher fitness than organizational forms with some routines left open to learning. Undecided routines are always less effective than their fixed counterparts in a static (though novel) environment because learning requires additional resources. Thus, organizational forms with high inertia will be favored by an evolutionary process, but only as long as a viable form has already been discovered and the environment does not change. However, this research demonstrates that organizational forms with learning capabilities, called *r*-strategies by Brittain and Freeman (1980), have a much higher probability of finding a new form in a novel environment. Organizational learning capabilities are therefore constantly injected into a population of organizational forms in a business environment in which new niches are regularly created.

The creation of novel organizational forms as a recombination of previously existing forms, which is a key feature of this model, has also recently been confirmed empirically. Van de Ven and Grazman found that health care organizations in the Minneapolis–St. Paul metropolitan area evolved over time by recombining existing organizational units and internal resources:

> The significant rise of organizational mergers, acquisitions, strategic alliances, and joint ventures during the past decade indicates that a growing form of organizational evolution is being produced by joining together resources and components of different organizations. . . . An understanding of these alternative ways to recombine ancestral organizational forms to create new ones is not captured by examining organizational birth and death rates in a population. Instead it requires a genealogical examination of how organizational forms were created, modified, and reproduced by the coupling, union, or interaction of their progenitors in a population (1994: 5)

Although the objective of this article is primarily theoretical, these correspondences of model features and results with independent empirical findings suggest to us that our model probably captures some essential aspects of organizational evolution.

Future Directions

In the computational model developed here, we made certain simplifying assumptions. Although we consider this a reasonable starting position, below we discuss ways in which these assumptions can be modified to increase the richness of the computational model.

A critical simplifying assumption of our model is the choice of an organizational fitness function (see Equation 1 and Figure 3), in particular, the sensitivity of the parameter values $c_0 = 1$, $c_1 = 20$, $c_2 = 10$. The shape of the fitness function determines (1) how quickly the first viable organizational form will establish itself as the dominant design (c_1 and c_2 relative to c_0) and (2) how rapid the incremental improvement will be (c_2 relative to c_1). The dominant organizational design establishes itself faster if the parameter values c_1 and c_2 increase relative to c_0. This means that a viable organizational form will be much fitter than its unsuccessful counterparts and that as soon as a viable form is discovered it will spread very rapidly through the population of organizational forms; that is, it will have a large number of offspring forms. Thus, all forms in subsequent generations will be close imitations of that first, flexible organizational design. This pattern prematurely locks an entire population into a dominant organizational design that is flexible but inefficient, and difficult to improve upon incrementally. Such an organizational design is not effective because flexible routines could be replaced by more efficient, inert routines. However, incremental improvement—that is, the replacement of flexible routines by inert but efficient ones—is difficult because the genetic variety of routines in the population has decreased since almost every organization has adopted the dominant design.

The effect of rapid spread of the first viable organizational form as the dominant design, at the expense of genetic variety of routines, is a form of premature convergence that can be detrimental to organizational evolution. Premature convergence is also an important variation in March's (1991) notion of exploration versus exploitation as a theme in the evolution of organizational populations. A population that adapts very quickly to a business environment will suffer from premature convergence because it overexploits routines that are discovered early and that increase organizational performance immediately. Whenever an organizational population adapts very rapidly to its environment, it lacks the variety within its gene pool of routines that is necessary for exploring further a new, better-performing organizational design. Thus, future organizational research should carefully study which variables affect premature convergence within an organizational population and how such convergence can be prevented to enable more effective adaptation to increasingly changing business environments.

The second process influenced by the shape of the fitness function is incremental improvement, or the replacement of flexible routines with more efficient but inert ones. Incremental improvement will be quicker if the parameter value of c_1 is increased relative to c_2 (if the negative slope in Figure 3 is increased). A strongly negative slope has the consequence that extensive learning is punished more severely—that is, the more time an organization needs to learn, the more fitness is decreased. In this case, the pressure to improve the organizational form incrementally (to change the undecided, flexible routines into efficient but fixed ones) is high. This statement has the following organizational interpretation. If it is expensive to keep an organization flexible (for example, if there are large economies of scale or learning effects), there will be strong pressure to incrementally improve on the initial dominant organizational design. Thus, one would expect to find highly efficient but inert organizational forms in industries in which there are large economies of scale or learning effects. One such example is the U.S. automobile industry, which underwent wrenching changes during the 1980s.

Another critical assumption of the model is that the fitness landscape does not change over time. The current model does not address continuous environmental change, whereby a population of organizations follows a moving fitness landscape. Continuous environmental change is a more elaborate case than the one-time discovery of a new business niche. If organizational learning can guide environmental selection while discovering a novel niche, then learning will guide a population even more in the case of a changing environment in which novel niches constantly open up. However, note that adding mutation, or playful experimentation (March, 1981), to our model would be critical in this more elaborate case. Mutation reintroduces into the gene pool of an organizational population the variety of routines that was lost during adaptation to a previous fitness spike and, therefore, mutation allows better adaptation to changing fitness landscapes. In other words, mutation of routines can help an organization find new directions when it gets stuck in a competency trap (Levitt & March, 1988) by shifting the organization from exploitation of current competencies to exploration of new, possibly better, ones (Levinthal & March, 1993; March, 1991).

This research demonstrates that a computational model based on the genetic algorithm can clarify difficult organizational issues, such as how organizational learning at the firm level of analysis interacts with environmental selection at the population level of analysis. The strength of the proposed model is that researchers can tailor portions of it to fit a particular investigation while keeping the rest of the model simple and clear. Several important new directions present plausible extensions of our computational model.

First, Darwinian and Lamarckian views of organizational evolution could be further elucidated by extensions of the model. Whereas the dominant approach in organizational ecology (Hannan & Carroll, 1992; Hannan & Freeman, 1989) exemplifies the Darwinian view, the Lamarckian view (Singh, 1990; Singh & Lumsden, 1990) in which intergenerational transfer of acquired learning is possible, is best exemplified by Nelson and Winter (1982) and research on organizational learning by March and colleagues (for a review, see Levitt and March [1988]). Although the current model is Darwinian, it can easily be changed to model Lamarckian evolution. The key change needed to achieve this is to perform recombination (crossover) of forms using the final organizational form that includes all specified routines from the last learning trial, instead of using the original organizational form, which includes unspecified routines. Organizations that follow Lamarckian evolution will adapt much more quickly to their environment than their Darwinian counterparts because Lamarckian evolution instantly preserves learned traits. However, as March (1991) and Levinthal and March (1993) pointed out, quick learning is a mixed blessing because firms will adopt the first, well-functioning organizational traits that are discovered and will not take time to explore potentially better ones. Put in different words, the quick learning capability of Lamarckian evolution can again lead to premature convergence within an organizational population.

A second direction would be to introduce a changing environment to study the convergence and reorientation of organizational forms (Lant & Mezias, 1990, 1992; Tushman & Romanelli, 1985). Changes in the environment can be modeled by varying organizational fitness landscapes over time. Studying changing fitness landscapes can provide important insights into the role organizational learning plays during phases of convergence and reorientation. Incremental improvement, driven by the replacement of flexible routines with more efficient but inert ones, will be beneficial during the convergence phase. In contrast, organizational learning will help locate new business niches during the reorientation phase. An extended version of the present computational model may illuminate when organizations might do well to increase or decrease their capability to learn, contingent upon different degrees of turbulence in the business environment.

A third direction concerns coevolution, a theme underscored in earlier writing (Singh, 1990; Singh & Lumsden, 1990) as important to the future study of organizational evolution. More recently, several studies using an explicitly coevolutionary approach have appeared (e.g., Baum & Singh, 1994; Rosenkopf & Tushman, 1994; Van de Ven & Garud, 1994). Our computational model can be modified to study coevolution by incorporating an organizational fitness landscape that is interdependent with another fitness landscape (e.g., Ahouse et al., 1992; Kauffman & Levin, 1987; Levinthal, 1994). This incorporation would allow investigation of coevolving organizational populations or industries, such as biotechnology firms and venture capital firms, TV networks and cable companies, or computer manufacturers, software firms, and telecommunication companies.

A fourth extension of the model would be to try to predict actual events of organizational evolution. For this purpose, the current model could be expanded in the following way. First, the selection of organizational forms could be made density dependent by introducing a carrying capacity (Hannan & Freeman, 1989), reflecting the view that only a limited number of firms can exploit a business niche. Second, to increase the realism of the model, we could introduce a probability for the birth and death of an organization instead of constantly recreating the entire population from one generation to the next. In such an extended model, organizations performing well would not die after one generation and but would continue to have many imitative offspring. The probabilities of birth and death could also be made density dependent. This extension of the model might be capable of providing deeper theoretical insight into the dynamics of organizational births and deaths. The two proposed expansions of the model make our model more realistic and could lead to empirically testable predictions about differences in the expected waiting times needed to discover a dominant organizational design between industries that differ on availability of inexpensive organizational learning trials.

We conclude that models based upon the genetic algorithm have the potential to clarify some of the more difficult but interesting questions that bear upon organizational evolution. In addition to the questions raised above, some other issues worthy of exploration using this model are extinction, or the death of organizational forms; speciation, or the creation of new organizational forms (Lumsden & Singh, 1990); and the interplay of different hierarchically nested levels of analysis (Singh & Lumsden, 1990), in particular, the interplay between ecological and genealogical hierarchies (Baum & Singh, 1994).

Although the primary thrust here has been theoretical, we think genetic-algorithm-based models can also illuminate a different and novel view of managers as "evolutionary engineers." In this view, which echoes earlier writings (e.g., Burgelman, 1991), novel organizational forms are recombinations of existing parts of firms and internal resources. Managers are seen as evolutionary engineers guiding the process of "breeding" high-performing, novel organizational forms (Bruderer, 1993; March, 1994; Van de Ven & Grazman, 1994). Genetic-algorithm-based models can help researchers make normative judgments on how to more effectively guide the evolution of complex modern firms. Computer simulations can readily generate a large number of possible evolutionary scenarios from which managers can choose the more effective ones for implementation in the real world.

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APPENDIX

Mathematical Model

A simple mathematical model of organizational evolution can approximate the expected waiting time, t_w, needed to discover the first viable organizational form. In this model, we make the simplifying assumption that recombining the organizational forms is equivalent to a random draw of routines, according to their initial probability distribution. This assumption is only adequate if a population of organizational forms is large, relative to the number of routines. A small population biases the process of organizational evolution because the possibilities of recombining existing routines are limited. The expression for the expected waiting time, t_w, can be derived from elementary probability theory as follows:

$$t_w = \frac{1}{\sum_{a=0}^{m} \left(\frac{m!}{a!(m-a)!} \times p_\alpha^a \times p_\beta^{(m-a)} \times p_\lambda\right)}, \qquad \text{(A1)}$$

where m is the total number of routines, a is the number of correct routines, p_α is the probability of drawing a correct routine, p_β is the probability of drawing an undecided routine, and $p_\lambda = 1 - (1 - (0.5)^{m-a})^N$ is the probability of discovering the correct organizational form in N learning trials.

The denominator of Equation A1 expresses the probability, p, of discovering a correct organizational form. This probability is the sum of the following probabilities: {(the probability of discovering an organizational form with 0 correct routines [1s] and 20 undecided routines [?] times the probability of discovering 20 correct routines through 1,000 random trials) + (the probability of discovering an organizational form with 1 correct routine and 19 undecided routines times the probability of discovering 19 correct routines through 1,000 random trials) + . . . +(the probability of discovering an organizational form with 20 correct routines)}. The expected waiting time, t_w, is the inverse of the probability of discovering the correct organizational form (Ross, 1988: 249).

For $m = 20$, $N = 1{,}000$ $p_\alpha = .25$, and $p_\beta = .5$ the expected waiting time is:

$$t_w = \frac{1}{\sum_{a=0}^{20} \left(\frac{20!}{a!(20-a)!} \times 0.25^a \times 0.5^{(20-a)} \times \{1 - [1 - (0.5)^{20-a}]^{1{,}000}\}\right)} \approx 1{,}793. \qquad \text{(A2)}$$

The mathematical model predicts that an average 1,793 organizational foundings are necessary for discovery of the first viable organizational form; the computer simulations predict 1,750 foundings. The two predictions are close, though it would be incorrect to compare the two results statistically because the assumptions for the two models differ.

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ENVIRONMENTAL CONDITIONS AT FOUNDING AND ORGANIZATIONAL MORTALITY: A TRIAL-BY-FIRE MODEL

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Unobserved heterogeneity in organizational frailty and population-level learning suggest a particular relationship between environmental conditions at founding and organizational mortality. Organizations founded in adverse environments experience higher initial mortality rates. However, beyond a certain age, survivors among such organizations have mortality rates that are lower than those of organizations founded in less adverse environments. These predictions are supported in analyses of the effects of population density and competitive intensity at founding on the mortality rate of U.S. brewery and Argentine newspaper organizations.

Environmental conditions at founding often have long-term consequences for organizational strategy, structure, and survival. In his seminal work on the imprinting of environmental conditions at the time of organizational founding, Stinchcombe recognized that "organizations formed at one time typically have a different social structure from those formed at another time" (1965: 154). Research on environmental imprinting has dealt primarily with the impact of founding conditions on the choice of specific organizational strategies and the likelihood of organizational change.[1] Kimberly (1975) showed that sheltered workshops founded before and during World War II had a rehabilitation orientation, but those founded after World War II had a production orientation. Meyer and Brown (1977) found that founding conditions and later environmental forces together influenced the degree of formalization in the organizational structure of public finance agencies. Boeker (1988) found that the period of organizational founding influenced the adoption of specific strategic postures in the U.S. semiconductor industry. Romanelli's (1993) study of the minicomputer industry

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[1] Another stream of imprinting research deals with the role of founder or founding team in setting the initial strategy of an organization and creating a distinctive culture (Kimberly, 1979; Schein, 1983). Initial organizational strategy and culture tend to become institutionalized and thus exert long-lasting effects on organizational change and performance (Boeker, 1989; Eisenhardt & Schoonhaven, 1990; Selznick, 1957: 5–22; Zucker, 1977).

showed that founding conditions have a lasting impact on organizational strategies. In a study of voluntary social service organizations, Tucker, Singh, and Meinhard (1990) found that a favorable institutional environment at founding increased the likelihood of core organizational changes whereas an unfavorable institutional environment at founding led to peripheral organizational changes.

Recent research has begun to address the impact of environmental conditions at founding on organizational mortality. The empirical evidence generated by this research suggests that organizations founded when the level of environmental resources is low and competition for these resources is high experience higher mortality rates. Researchers have typically assumed that the effect of adverse environmental founding conditions on organizational mortality is either permanent and unchanging (Romanelli, 1989) or an initial liability that declines proportionally (relative to other organizations' liability to fail) over an organization's lifetime (Carroll & Hannan, 1989). In this study, I propose and test a "trial-by-fire" model of the effects of environmental founding conditions on organizational mortality. It is plausible that the higher mortality rates experienced by organizations founded in adverse environmental conditions may not be permanent. In fact, although many organizations may fail in the process, early adversity may later prove beneficial for surviving organizations for at least two reasons. First, adverse founding conditions may eliminate the inherently weaker, or more frail, organizations quickly, leaving behind a surviving cohort of inherently stronger, less frail, organizations. In other words, unobserved heterogeneity in organizational frailty in a population could result in a population of survivors with lower mortality rates. In addition, adverse conditions feature a high organizational failure rate and thus afford greater opportunities for population-level learning (Miner & Haunschild, 1995). Surviving firms are more likely to have been exposed to organizational routines that result in failure and through a process of vicarious learning avoid the development or acquisition of such routines (Delacroix & Rao, 1994: 264–266). The trial-by-fire model extends the frontiers of organizational ecology by examining the possibility that the impact of environmental conditions at founding on organizational survival vary over an individual organization's life cycle. It also provides a partial resolution of an apparent paradox—that many of the firms that presently dominate industries were founded in periods in which industry incumbents faced adverse environmental conditions.

Carroll and Hannan (1989) proposed a general model that related density (the number of organizations in a population) at the time of founding to organizational survival. Carroll and Hannan's (1989) model of the delayed effects of density is an extension of Hannan's (1986) model of density-dependent organizational evolution (cf. Hannan & Carroll, 1992; Singh & Lumsden, 1990). Organizations founded in periods of high density are predicted to have higher age-specific mortality rates. Both supply-side and demand-side resources may be scarce in high-density periods, conditions that spawn smaller and more fragile organizations. Alternatively, high density may imply a tightly crowded niche, or market, whose new entrants must rely on precarious activities at the boundaries of the established resource space. Both resource scarcity and tight niche packing generate long-lasting effects in that organizations founded in high-density environments may have higher mortality rates at all ages. Carroll and Hannan (1989) found support for this model in five different organizational populations—American national labor unions, American breweries, and newspapers in Argentina, Ireland, and the San Francisco metropolitan area. According to their formulation, both resource scarcity and tight niche packing affect only the initial mortality rate. That is, organizations born in high-density periods have higher initial mortality, but as they age, this effect diminishes, and the mortality of all organizations tends toward a common asymptotic rate.

Romanelli (1989), however, found that young firms in the minicomputer industry had a constant, higher likelihood of survival when demand for their products was rising around the period of their founding. If the effects of founding conditions on organizational mortality are permanent, then the asymptotic death rate of organizations born in periods of high environmental adversity will be greater than those of other organizations by a constant amount.

In this article, I evaluate three alternative conceptualizations of the persistent effects of adverse environmental founding conditions on organizational mortality rates. These have to do with organizational processes concerning (1) initial liability (2) permanent, unchanging liability, and (3) a trial by fire consequent to early adversity. I tested these alternative specifications of the effects of founding conditions on organizational mortality using two organizational populations—American breweries and Argentine newspapers. In addition to the effects of density at founding, I examined the impact of two other founding conditions: competitive intensity related to the aggregate experience of competitors (Barnett, 1993) and political turmoil (Carroll & Delacroix, 1982).

THEORY AND HYPOTHESES

This study's view of environmental founding conditions is an elaboration of the concept of the "liabilities of newness" that young organizations face (Aldrich & Auster, 1986; Freeman, Carroll, & Hannan, 1983; Stinchcombe, 1965). The liability of newness argument links problems faced by individual young organizations, such as barriers to entry, lack of ties to external actors, inability to attract skilled labor, and difficulties of internal organization, to an increased risk of failure. However, environmental conditions at founding affect the entire cohort of organizations founded in the same period. The mortality rates of organizations in a particular cohort may depend not only on organizational age, as suggested by the liability of newness argument, but also on the interaction between organizational age and initial conditions such as environmental conditions at founding.

Carroll and Hannan (1989) suggested two explanatory mechanisms—resource scarcity and tight niche packing—for the persistent effects of environmental founding conditions (density at founding) on organizational mortality rates. They argued that both resource scarcity and tight niche packing affect the initial mortality rate of organizations. In contrast, I argue below that resource scarcity results in an initial liability only, but tight niche packing results in a permanent liability for organizations founded under those conditions. This difference occurs because resource scarcity hampers the initial development of organizational capabilities, whereas tight niche packing affects the permanent competitive position of organizations within a population. I am assuming, therefore, that competitive positions are more difficult to change than organizational capabilities and reflect imprinting at the time of founding (Boeker, 1988).

Initial Liability

Periods of high density are likely to be characterized by resource scarcity. Resource scarcity means that initial organizational structure and processes are underdeveloped and that the usual organizational assets may not be available. Such impoverishment may be evident across the board, reflecting a generally lower quality and diminished abundance of all resources. Or it may be limited to a few critical resources. In either case, organizations founded under conditions of scarcity are disadvantaged relative to both existing organizations and other new organizations.

Organizations founded with scarce resources may also encounter difficulty in progressing from the formative stage to routine operations. The time and energy required to learn roles in the new organization may not be available. The coordination of these roles requires a level of cooperation that may not be forthcoming. Employees of resource-deprived organizations have little incentive to acquire firm-specific skills. Lack of employee motivation exacerbates the problems involved in developing organizational routines. Inability to create standardized routines implies that organizational structures cannot be reproduced.

Organizations founded under conditions of resource scarcity are more likely to experience capital and cash-flow problems since both consumers and suppliers have greater bargaining power in this context. The problem is not restricted to the scarcity of material resources. For instance, nonprofit organizations may face difficulty in acquiring sponsorship by government agencies and other influential institutions. Even the organizations that survive these initial selection pressures may be at greater risk throughout their lifetimes (Levinthal, 1991). In a similar vein, Winter (1990) argued that organizations founded early in a population's history, when density is low, have greater growth opportunities and are less likely to fail. Utterback and Suárez (1993) showed that peak density in six different industries was achieved soon after the emergence of a dominant technological design. In a subsequent study, they found that firms that entered in the high-density period following the emergence of a dominant design suffered higher failure rates (Suárez & Utterback, 1995). They attributed this result to, among other reasons, earlier entrants' accumulation of scarce collateral assets such as market knowledge, distribution networks, and reputation.

Carroll and Hannan (1989) specified that the effect of adverse founding conditions—more specifically, density at founding—operates primarily on the mortality rate of new firms. According to their specification, the absolute effect of founding conditions weakens with organizational age (although the relative effect remains the same). That is, organizations founded in a high-adversity period will always have a proportionately higher mortality rate than those founded in a low-adversity period, but the absolute difference in the rates declines with age. Further, the death rate for all organizations is assumed to approach a common asymptote at some high value of organizational age. This argument suggests

> *Hypothesis 1: The liability associated with adverse founding conditions affects only the initial mortality rate of organizations within a population.*

Permanent Liability

An alternative argument is that highly adverse founding conditions may result in a permanent, unchanging liability for cohorts of organizations born in such periods. This concept is consistent with a strong version of Stinchcombe's (1965) argument about imprinting of environmental conditions at the time of an organization's founding.

Strong assumptions about environmental imprinting are consistent with the other explanation advanced for the positive relationship of founding density with organizational mortality rates, which relies on a process of tight niche packing. According to this explanation, few resources remain unexploited in high-density periods because the niche (market) is tightly packed with competitors. Organizations founded in such periods are at a disadvantage in attempting to compete for resources with established organizations. To avoid this intense competitive pressure, they may operate in the periphery of the resource distribution, attempting to develop markets that are not as bountiful as those on which existing organizations depend. Often these organizations are forced to try new and precarious activities.

Some newly founded organizations may succeed in operating on the periphery. But in the process they become specialized in exploiting inferior regions of the resource space. Any attempt to move toward the more munificent center is risky since reorganization is difficult in and itself (Amburgey, Kelly, & Barnett, 1993; Hannan & Freeman, 1984). Successful reorganization brings with it additional problems because the organization must now compete with established organizations already fine-tuned for the center. For all these reasons, tight niche packing may generate higher mortality rates.

According to the tight niche-packing argument, founding density conditions influence primarily the strategic orientation of newly founded organizations. In a high-density environment, the process manifests itself in attempts by newly founded organizations to establish themselves in marginal resource areas, a competitive position that is difficult to alter. Thus, high adversity at founding due to tight niche packing will elevate organizations' mortality rates by a constant amount throughout their lifetimes. This argument leads to

> *Hypothesis 2: The liability associated with adverse founding conditions affects only the asymptotic mortality rate for organizations within a population.*

Trial by Fire

Models that associate environmental founding conditions with the initial or asymptotic mortality rate ignore the possibility that the relative mortality rates of organizations founded under varying degrees of environmental adversity fluctuate with organizational age. Specifically, organizations founded in a high-adversity period may be subject to a trial by fire. These organizations may have a higher initial mortality rate than organizations founded in a low-adversity period, but survivors of this early trial may ultimately experience a lower death rate than organizations founded in a low-adversity period. One plausible reason is that severe early selection pressures may result in the survival of stronger organizations. Two mechanisms can lead to such an outcome: unobserved heterogeneity in organizational frailty (susceptibility to failure) and population-level learning.

Unobserved heterogeneity in organizational frailty. Assume that, under constant mortality rates, two types of organizations are founded: low- and high-frailty. High-frailty organizations can be characterized as having fewer initial organizational capabilities and therefore as being more susceptible to failure. High-frailty organizations tend to be selected out at a much faster rate under adverse environmental conditions. Therefore, average initial mortality rates for organizations founded under adverse environmental conditions are higher. When environmental conditions are favorable, however, the selection process is slower, and many high-frailty organizations are allowed to survive until a greater age. Cohorts of organizations founded under adverse environmental conditions would thus have a greater proportion of low-frailty, or stronger, organizations at higher age levels. Therefore, beyond a certain crossover point, the mortality rate of organizations founded under adverse environmental conditions is likely to be lower than that of organizations founded under favorable environmental conditions (see Vaupel, Manton, and Stallard [1979] and Vaupel and Yashin [1985a, 1985b] for applications in human demography).

Population-level learning. Miner and Haunschild defined population-level learning as "systemic change in the nature and mix of organizational action routines in a population of organizations, arising from experience" (1995: 118). The aspect of population-level learning that applies to the trial-by-fire model is that organizations can use the experience of other organizations in ways that alter the mix of routines in an entire population. There is some empirical evidence that vicarious learning of this sort depends on the characteristics of prior adopters or the outcomes generated by prior adopters. Burns and Wholey (1993) found that the adoption of matrix management by high-prestige hospitals influenced lower-prestige hospitals in their network to do the same. Haveman (1993) showed that the density of successful savings and loan associations in a particular market encouraged the entry of other savings and loan associations into that market. Adverse environmental conditions are likely to result in a greater degree of exploration by members of an organizational population. For example, Miner, Amburgey, and Stearns (1990) found that exogenous shocks captured by periods of foreign-news censorship and wars were associated with a greater likelihood of organizational change within a population of Finnish newspaper organizations. Delacroix and Swaminathan's (1991) study of organizational change in the wine industry showed that unpredictability of demand and large fluctuations in demand increased the likelihood that individual wineries would change their brand portfolios. Adverse environmental conditions are also associated with higher organizational failure rates. The increased rate of organizational action combined with the increased rate of organizational failure that accompanies adverse environmental conditions facilitates population-level learning to the extent that the adoption of specific organizational actions or routines can be identified with failure. Thus, organizations founded under adverse environmental conditions are initially more likely to fail but are also able, through a process of selective copying, to avoid acquiring routines associated with organizational failure. Therefore, in the long run such organizations may suffer a lower mortality rate than organizations that are founded when selection pressures are lower.

> *Hypothesis 3: Organizations founded under adverse conditions will experience initially higher death rates and then lower death rates at later ages.*

In addition to the effects of density at founding, I considered the effects on organizational mortality rates of two other environmental founding conditions—competitive intensity based on the experience of competitors, and political turmoil. These founding conditions are expected to have the adverse consequences for organizational survival explained below.

Competitive Intensity at Founding

According to the density model, at the organizational level competition depends only on the likelihood that organizations will attempt to exploit the same resources. Not addressed is the intensity of competition generated by individual organizations. Barnett and Amburgey (1990) proposed a "mass dependent" model in which population mass, or the sum of the sizes of all organizations, drives population-level competition. In this model, an organization's competitive strength is measured by its size and competitive intensity is measured by the sum of the sizes of all competitors. In their study of telephone companies, Barnett and Amburgey (1990) did not find support for their hypothesis that larger organizations generate stronger competition. More recently, Barnett (1993) suggested that unobserved competitive abilities of organizations determine both the fitness of the organization with respect to its environment and the competitive intensity it generates against other organizations in the population. Older organizations generate stronger competition because they fit their environment better than younger organizations. This assumption is consistent both with Stinchcombe's (1965) arguments about the liability of newness and with models of unobserved heterogeneity in organizational capabilities, according to which the more capable firms survive to grow older (Brüderl & Schüssler, 1990; Levinthal, 1991). In a study of the telephone and brewing industries, Barnett (1993) found that competitive intensity as indexed by the aggregate age of living competitors elevated organizational mortality rates.

Competitive intensity is likely to have both contemporaneous and persistent effects related to conditions that exist at the time of an organization's founding. Organizations founded in periods of high competitive intensity are likely to face resource constraints that are similar to those encountered by organizations founded in high-density environments. Further, as Barnett (1993) emphasized, density and age-based competitive intensity capture two different dimensions of competition within a population. Competitive effects attributed to increasing density play themselves out through the crowding out of less fit organizations, whereas an increase in age-based competitive intensity captures the greater competition that is generated by older, more experienced organizations. Older organizations may not only be advantageously placed with respect to resource acquisition, but are also likely to utilize resources more productively. Organizations founded in periods of high competitive intensity therefore face more formidable competitors than do those founded in periods of low competitive intensity. Thus, high competitive intensity, like high density, is an indicator of adverse founding conditions.

Political Turmoil at Founding

Carroll and his collaborators (Carroll & Delacroix, 1982; Carroll & Huo, 1986) showed that newspapers founded in turmoil-ridden years experienced higher mortality rates than those founded in more peaceful times. They offered two explanations for their findings. First, newspapers founded during years of political turbulence are usually established for specific political purposes and therefore become irrelevant once the political crisis is resolved. Second, political turmoil reflects an environmental discontinuity in that it alters links between social groups and societal resources. Resources are typically freed during such periods of realignment. Newspapers founded during such periods are likely to be organizations that can exploit freed-up resources in an opportunistic manner, the so-called r-strategists (Brittain &

Freeman, 1980). But once political stability is reestablished such opportunistic organizations will be "outcompeted" by more efficient organizations, the so-called K-strategists (Carroll, Delacroix, and Goodstein [1988: 362–368]; see also Baum [1995: 183–185] for a more general discussion of temporal changes in the basis of competition within organizational populations).

Though high levels of organizational density, competitive intensity, and political turmoil at the time of founding reflect adverse environmental conditions that are likely to have persistent effects on organizational mortality, it is substantively important to identify the component of the organizational mortality rate that these adverse founding conditions affect. Each of these founding conditions could affect—either singly or in combination—the initial mortality rate, the asymptotic mortality rate, and the slope at which the mortality rate approaches the asymptote (that is, the interaction of founding conditions with organizational age). I derive specific predictions from these modeling considerations below.

MODELING THE EFFECTS OF FOUNDING CONDITIONS

Following Freeman, Carroll, and Hannan (1983), I used Makeham's law to model the effects of founding conditions on organizational mortality rates (cf. Carroll, 1987: 73–78). The Makeham model includes three vectors: α, β, and γ. Assuming that the γ vector is negative, the β vector is associated with the initial mortality rate, the α is associated with the asymptotic mortality rate, and the γ vector measures the speed with which the asymptotic death rate is reached. The following equation for the organizational mortality rate illustrates the theoretical assumptions implicit in including the variables specifying founding conditions in one or more of the three vectors of the Makeham model (see Carroll [1984], Singh, House, and Tucker [1986], and Singh, Tucker, and House [1986] for earlier examples of specifying covariates in different vectors of the Makeham model).

$$\mu_i(t) \exp\,[\alpha_0 + \alpha_3 C_f] + \exp\,[\beta_0 + \beta_3 C_f + \beta_4 X_i] \exp\,[(\gamma_0 + \gamma_3 C_f)t], \quad (1)$$

where $\mu_i(t)$ is the death rate of the ith organization at age t, C_f reflects the adversity of founding conditions, and X_i is a vector of other covariates. The coefficient γ_0 captures the effect of organizational age on the mortality rate. Research on a wide variety of organizations has shown that mortality rates tend to decline with organizational age (Carroll, 1983). That is, γ_0 usually takes a negative value. Stinchcombe (1965) suggested several sociological factors that account for this effect, which he labeled the "liability of newness." In Equation 1, the coefficient β_3 captures the effect of founding conditions on the initial mortality rate, and α_3 captures the effect of founding conditions on the asymptotic death rate. The interpretation of γ_3 is somewhat more complicated. If the value of the γ vector becomes positive, the overall model predicts increasing age dependence. However, if the γ vector remains negative over the range of values for C_f, then a positive value for γ_3

suggests that organizations born with higher values of C_f reach the asymptotic death rate in a longer period of time—that is, their liability of newness is prolonged (Freeman et al., 1983: 698). The converse is true if γ_3 takes a negative value, given that the γ vector is negative. Equation 1 permits specification of the alternative hypotheses regarding the effects of founding conditions on organizational mortality rates in terms of predictions for the coefficients α_3, β_3, and γ_3. The predictions of Hypotheses 1 and 2 can now be restated as $\alpha_3 = 0$; $\beta_3 > 0$; and $\gamma_3 = 0$ and $\alpha_3 > 0$; $\beta_3 = 0$; and $\gamma_3 = 0$, respectively.

In addressing a trial-by-fire argument, Carroll and Hannan (1989) arbitrarily assumed that the trial occurs in the year of founding. A less restrictive interpretation allows the shakeout process to be longer (although of course it must remain short relative to the maximum organizational age observed). The length of the trial likely depends on the strength of selection pressures at founding and the speed at which surviving organizations eliminate failure-inducing routines. This time frame is likely to vary both by type of founding condition and by type of organizational population and is best treated as an empirical issue. The following hypothesis involves the estimation of models that do not specify a priori the length of the trial. Using Equation 1, the unrestricted version of the trial-by-fire hypothesis leads to the following specific predictions for Hypothesis 3: $\beta_3 > 0$; $\gamma_3 < 0$; and $|\gamma_3 t| > |\beta_3|$ at some $t < t_{\max}$, where $t = \{0,1,2, \ldots t_{\max}\}$. In this case, t denotes organizational age and $t_{\max}$ the maximum observed age in the population. Hypothesis 3 implies that after some value of organizational age, the death rate of firms founded under highly adverse conditions will be lower than that of firms founded under less adverse conditions.

DATA AND METHODS

I used event-history data on American breweries and Argentine newspapers to test Hypotheses 1 through 3. Obtaining unbiased estimates of the effect of founding conditions on organizational mortality rates requires a complete history of founding conditions for all organizations in a population. Left-censored event-history data are problematic because information on founding conditions for left-censored organizations is unavailable. The data used in this study do not suffer from left-censoring and are therefore particularly well suited to evaluating the effects of environmental founding conditions on organizational mortality rates. Besides, previous research using these data provides well-specified baseline models of organizational mortality rates (Carroll & Delacroix, 1982; Carroll & Hannan, 1989; Carroll & Swaminathan, 1991; Hannan & Carroll, 1992).

Brewery Data

I used event-history data on all American beer producers existing from 1633 to 1989. Carroll and Swaminathan (1989) documented the basic data set used here, so I give only a brief description. Bull, Friedrich, and Gottschalk's (1984) *American Breweries* constitutes the primary source of life-history data on the population of brewing firms. This source includes data on all American beer producers, except contract brewers who produced beer under contract to others. The event-history data on foundings and deaths has been aggregated to the firm level. I used the Modern Brewery Age *Bluebooks,* Tremblay and Tremblay (1988), and the *Microbrewery Resource Handbooks* (produced by the Institute for Fermentation and Brewing Studies) to extend the data through the end of 1989.

From the event-history data, I calculated the numbers of foundings and deaths and the density in any given year. These variables are lagged by one year in all the models estimated here. I also constructed a dummy variable to capture the onset of periods of state and federal alcohol prohibition. The relevant dates were extracted from Friedrich and Bull (1976). Another dummy variable was coded to take a value of 1 if firms operated without a permit and 0 otherwise because Carroll and Swaminathan (1991) found that mortality rates are higher for firms operating without permits. Bull and colleagues (1984) recorded 1,278 foundings in 1874, an unusually high number that is probably an artifact of their original sources. Following Carroll and Swaminathan (1991), I coded a dummy variable for firms founded in 1874 to control for any possible bias. Competitive intensity at founding was calculated as the aggregate age of all competitors in the industry in the year of founding.

Historical overviews of the American brewing industry can be found in Baron (1962), Cockerill (1977), and Elzinga (1986). The pattern of evolution in the American brewing industry conforms to that reported by Carroll (1984) for several other organizational populations. Specifically, slow initial growth is followed by rapid proliferation to a peak, which is followed by a precipitous decline in numbers. The data indicate that the maximum density reached was 2,726 in 1875. The density of brewing firms remained at 0 over the period 1920–33 because of the federal Prohibition.

The decline in numbers beginning in 1876 resumed after the repeal of Prohibition. American brewery density declined from 939 in 1934 to a low of 43 in 1981 and 1983. This decline is also reflected in industry concentration levels. The four-firm concentration ratio increased from 11 percent in 1935 to 78 percent in 1982, according to the Census of Manufactures. Increasing concentration levels are typically taken as evidence for the existence of economies of scale in the industry (Elzinga, 1986). Both beer production and advertising apparently provided economies of scale to the largest firms (Greer, 1971, 1981; Peles, 1971). Acquisitions and mergers within the industry also contributed to the reduction in the number of breweries in the post-Prohibition period (cf. Tremblay & Tremblay, 1988). The long-term decline has been reversed in recent years, with the number of American breweries increasing from 43 in 1983 to 190 by the end of 1989. Most of the new entrants are either microbreweries or brewpubs.

Newspaper Data

I analyzed event-history data that enumerated the complete historical populations of newspapers in Argentina from 1800 through 1900. The data on Argentine newspapers were extracted from two books on the history of Argentine journalism, *Historia del periodismo Argentino* (Fernandez, 1943) and *El periodismo Argentino, amplia y documentada historia desde sus origenes hasta el presente* (Galvan-Moreno, 1944). A complete discussion of these data sources and their quality can be found in Carroll (1987). The Argentine newspaper population is censored by a lack of data soon after it attains its peak of 125 in 1898.

Following Carroll and his collaborators (Carroll & Delacroix, 1982; Carroll & Huo, 1986), I included a dummy variable for years of political turmoil in the mortality models for newspaper organizations. Following previous findings (Carroll & Huo, 1986; Delacroix & Carroll, 1983), I also included quadratic specifications of the number of foundings and the number of failures in the preceding year. These can be interpreted as controls for short-term variations in the environment that surrounds newspaper organizations. Following Carroll and Hannan (1989), I also included in the mortality models a variable called population age, defined as the time elapsed since the founding date of the first recorded newspaper in the population. Competitive intensity at founding was calculated by summing the ages of all competing newspapers in the year of founding.

Methods

Following previous ecological research (cf. Hannan & Freeman, 1989: 178–188), I modeled the effects of covariates on the instantaneous mortality rate. For the *i*th organization this rate is given by

$$\mu_i(t) = \lim_{\Delta t \to 0.} \Pr\{\text{dead at age } t + \Delta t \mid \text{alive at age } t\}/\Delta t$$

The Gompertz model has been most widely used in ecological research on organizational mortality. In this model, the mortality rate is specified as

$$\mu_i(t) = \exp[\beta_0 + \beta_4 X_i]\exp[\gamma_0 t], \tag{2}$$

where X_i is a vector of covariates, β_4 is a vector of regression coefficients, and t is the age of organization *I*.

Carroll (1983) found that Makeham's law yielded a better specification of the mortality rate in organizational populations with low levels of censoring. Makeham's law differs from the Gompertz model in that it contains an additional parameter to make the asymptotic death rate nonzero. This specification gives the mortality rate as

$$\mu_i(t) = \exp[\alpha_0] + \exp[\beta_0 + \beta_4 X_i]\exp[\gamma_0 t], \tag{3}$$

where the coefficient γ_0 determines the extent of the asymptotic death rate. In order to test the alternative specifications of the effects of density delay, I used the mortality model described earlier by Equation 1, $\mu_i(t) = \exp[\alpha_0 + \alpha_3 C_f] + \exp[\beta_0 + \beta_3 C_f + \beta_4 X_i]\exp[(\gamma_0 + \gamma_3 C_f)t]$, where $\mu_i(t)$ is the death rate of the *i*th organization at age *t*, C_f relates to founding conditions, and X_i is a vector of other covariates.

To facilitate estimation, each organization's life history was divided into a series of annual "spells," with all but the last spell treated as right-censored (cf. Tuma & Hannan, 1984). Organizations still alive at the end of the observation period were also treated as censored on the right.

The values of time-varying covariates such as age, density, and the number of foundings and failures in the preceding year were updated at the beginning of each year for each organization. I assumed that covariates changed as annual step functions and that they were constant within years (cf. Tuma & Hannan, 1984: 197–208).

I estimated the parameters of various models using maximum likelihood methods that accommodate right-censored data, using the statistical package RATE Version 2.0 (Tuma, 1980) for estimation. In the tables, I only report coefficient estimates for the effects of founding conditions and organizational age. For each model, I provide the change in the model likelihood chi-square ratio resulting from adding the founding condition variable to baseline models of organizational mortality rates. The baseline mortality rate model for American breweries includes the following covariates: organizational age, contemporaneous density and its square, foundings in the previous year, failures in the previous year, and dummy variables denoting operating without a permit, founding in 1874, and years immediately prior to any federal or state prohibition. The baseline mortality rate model for Argentine newspapers includes the following covariates: organizational age, contemporaneous density and its square, age of population, foundings in the previous year and its square, and failures in the previous year and its square. These baseline models are based on previous research on organizational mortality in these populations (Carroll & Hannan, 1989: 429–430). Though the baseline models for breweries and newspapers do not use identical sets of covariates to explain organizational mortality, they facilitate comparison of the results of this study with previous findings.

FINDINGS

Density at Founding

Table 1 presents alternative specifications of the effect of founding density on organizational mortality rates.[2] Models 1 through 4 refer to American breweries and models 5 through 8 to Argentine newspapers. Model 1 supports Carroll and Hannan's (1989) interpretation of the effect of founding density. As predicted by Hypothesis 1, β_3 is more than 0 and is significant.

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[2] The complete mortality models for both organizational populations are available from the author upon request.

TABLE 1
Effects of Density at Founding and Organizational Age on the Mortality Rate of American Breweries and Argentine Newspapers[a]

	Models			
American Breweries[b]	1	2	3	4
α_3 (density at founding in α vector)		.00103*		.0007
		(.00007)		(2.7370)
β_3 (density at founding in β vector)	.00051*		.00085*	.00085*
	(.00002)		(.00003)	(.00003)
γ_0 (organizational age)	–.01087*	–.01287*	.00514*	.00514*
	(.00093)	(.00114)	(.00128)	(.00128)
γ_3 (density at founding in γ vector)			–.000016*	–.000016*
			(.000001)	(.000001)
$\Delta\chi^{2c}$	638.43*	316.20*	878.43*	878.43*
df	1	1	2	3

	Models			
Argentine Newspapers[d]	5	6	7	8
α_3 (density at founding in α vector)		–.01961		–.00164
		(.01304)		(.01009)
β_3 (density at founding in β vector)	.01883*		.01876*	.01886*
	(.00566)		(.00578)	(.00579)
γ_0 (organizational age)	–.3453*	–.3606*	–.2168*	–.2222*
	(.0261)	(.0261)	(.0481)	(.0589)
γ_3 (density at founding in γ vector)			–.00229*	–.00217
			(.00083)	(.00111)
$\Delta\chi^{2c}$	11.14*	3.51	19.23*	19.26*
df	1	1	2	3

[a] Standard errors are in parentheses.

[b] The baseline mortality rate model for American breweries includes the following covariates: organizational age, contemporaneous density and its square, foundings in the previous year, failures in the previous year, and dummy variables for founding in 1874, for years immediately prior to any federal or state prohibition, and for operating without a permit.

[c] Relative to baseline model.

[d] The baseline mortality rate model for Argentine newspapers includes the following covariates: organizational age, contemporaneous density and its square, age of population, foundings in the previous year and its square, and failures in the previous year and its square.

* $p < .05$

Founding density has a significant, positive effect on the initial mortality rate. Model 2 shows that founding density has a significant, positive effect on the asymptotic death rate. But this effect is reduced to insignificance in the more complete model 4 when I modeled together the effects of founding density on the initial mortality rate, the asymptotic mortality rate, and the speed at which the asymptotic mortality rate is reached. It seems, therefore, that the effect of founding density does not remain constant over an organization's lifetime, as Hypothesis 2 predicts. High founding density apparently does not result in a fixed liability in terms of a higher asymptotic death rate for cohorts of organizations founded in such periods. Models 3 and 4 provide support for Hypothesis 3, which assumes a trial by fire at founding.[3] As noted, the first part of Hypothesis 3 predicts that β_3 will be greater than 0 and that γ_3 will be less than 0. Consistent with Carroll and Hannan (1989), founding density increases the initial mortality rate ($\beta_3 > 0$)—but survivors of this trial by fire have lower death rates with increasing age ($\gamma_3 < 0$).

The second part of Hypothesis 3 predicts that, within the observed range of organizational age, the mortality rate of firms founded under highly adverse conditions will be lower than that of firms founded under less adverse conditions. Specifically, $|\gamma_3 t| > |\beta_3|$ at some $t < t_{\max}$, where $t = \{0,1,2, \ldots t_{\max}\}$ denotes organizational age and $t_{\max}$ denotes the maximum observed age in the population. The effect of any combination of variables on the mortality rate can be depicted in terms of a multiplier of the unobserved mortality rate. This multiplier is obtained by exponentiating the product of the estimated coefficient of any variable over the range of values for that particular variable. For instance, I use coefficient estimates for founding density and organizational age from model 3 of Table 1 to calculate their combined effect in terms of a brewery mortality rate multiplier as follows:

$$\exp[(.00085 \times \textit{founding density}) + (.00514 \times \textit{age}) + (-.000016 \times \textit{founding density} \times \textit{age})]. \tag{4}$$

Figure 1 plots the implied multipliers of the mortality rate due to founding density for breweries born in the periods encompassing the highest (2,726) and the mean (346) observed densities at founding. These multiplier plots are based on estimates of age dependence and founding density effects in model 3. I found that breweries founded in the highest-density environment (2,726 breweries) had a initial mortality rate that was 7.4 (9.953 divided by 1.342) times the initial mortality rate of breweries founded in the mean-density environment (346 breweries). But this different mortality rate diminished with organizational age. Beyond a certain age—53 years—breweries founded in the highest-density environment actually had a lower death rate than those founded in the mean-density environment. Given that the organizational age observed in the American brewery population varies from 0.5 to 133 years, the crossover point of 53 years for the organizational mortality of breweries founded in the highest-density and mean-density environments is well within this range.

Models 5 through 8 in Table 1 present the various effects of founding density on the mortality rate of Argentine newspapers. The results are similar to those obtained for American breweries. Model 5 shows that β_3 is greater than 0, as predicted by Hypothesis 1. Model 6 does not support

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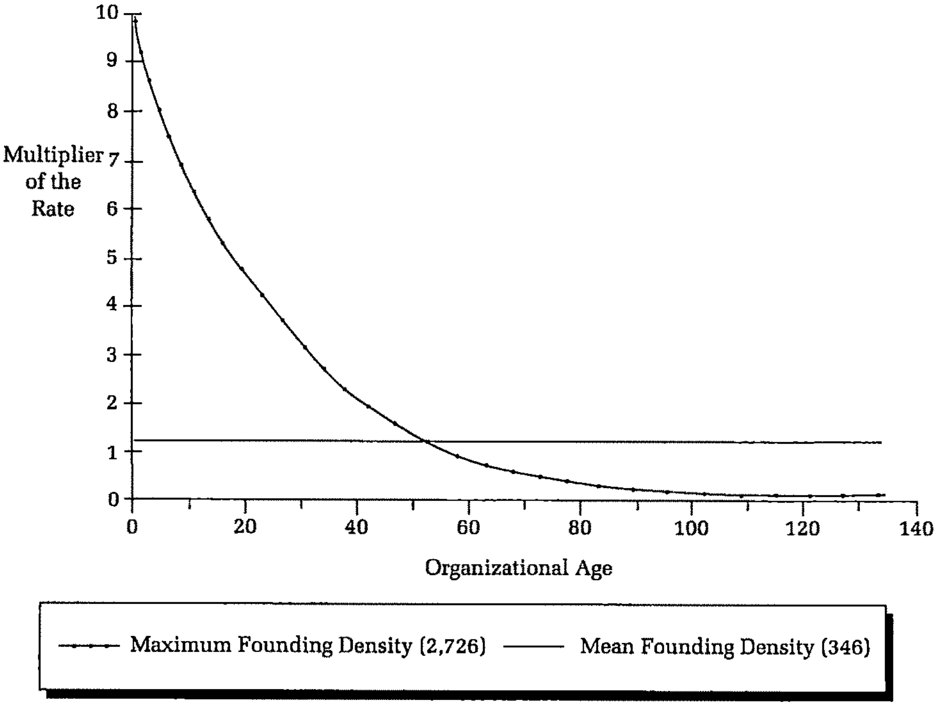
[3] The standard error for the coefficient estimate of α_3, increases significantly in model 4 over that in model 2, likely because of the inclusion of the same covariate in all three vectors of the Makeham model. However, the model converged to a solution in roughly the same number of iterations. The standard errors for estimates of α_3 for the Argentine newspaper population do not exhibit much variation as seen in models 6 and 8.

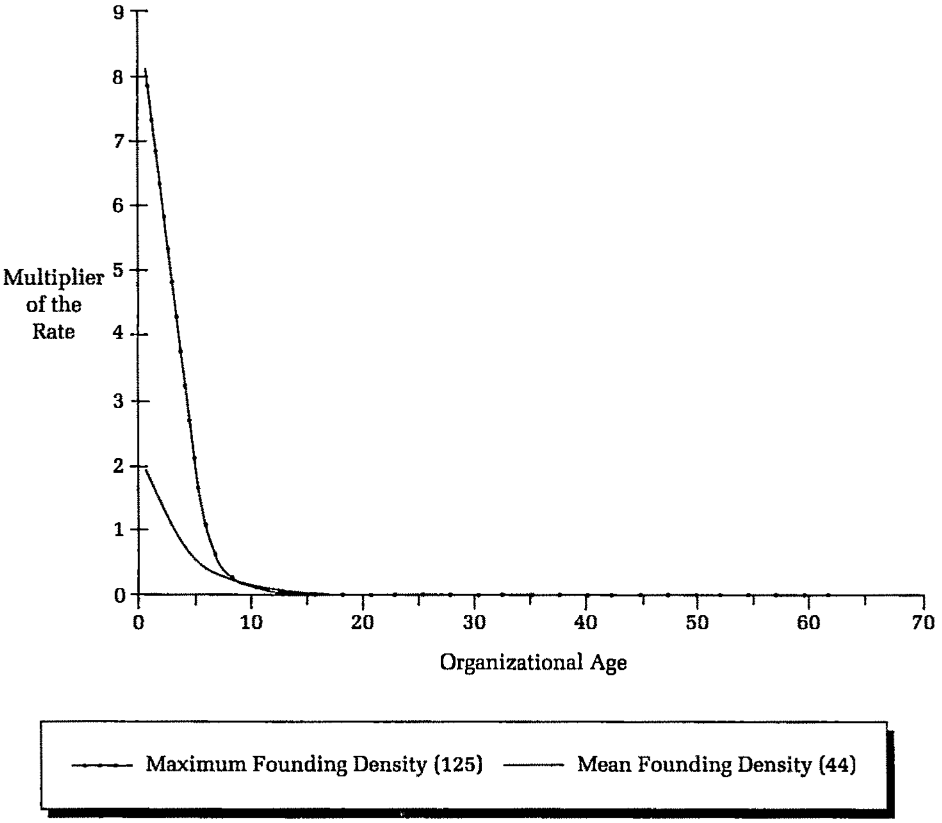
FIGURE 1
Estimated Effect of Founding Density on the Mortality Rate of U.S. Breweries 1633–1989



Hypothesis 2—founding density does not have a significant effect on the asymptotic mortality rate. Model 7 confirms Hypothesis 3, which is based on a trial by fire at founding. As predicted by Hypothesis 3, β_3 was greater than 0 and γ_3 was less than 0. The initial death rate of Argentine newspapers founded in a high-density environment is higher. But the death rate of survivors from such disadvantaged cohorts is lower than those of other organizations after a certain period of time. Model 8 substantiates this result.

Figure 2 plots the implied multipliers of the mortality rate due to founding density for organizations born in the periods encompassing the highest (125) and the mean (44) observed densities. These multiplier plots are based on estimates of age dependence and founding density effects in model 7. The initial mortality rate of newspapers founded at a density of 125 is 4.2 (8.113 divided by 1.948) times the initial mortality rate of newspapers founded at a density of 44. But after the age of 8 years, organizations founded in the highest-density environment experienced a lower death rate than those founded in the mean-density environment. The organizational age observed in the Argentine newspaper population varied from 0.5 to 61 years. Thus, the crossover point of 8 years for the organizational mortality of Argentine newspaper organizations founded in the highest-density and mean-density environments is within this range.

FIGURE 2
Estimated Effect of Founding Density on the Mortality Rate of Argentine Newspapers 1800–1900



Competitive Intensity at Founding

Table 2 presents the effects of competitive intensity at founding on the mortality rate of American breweries and Argentine newspapers.[4] Models 3 and 7 show strong support for the trial-by-fire hypothesis in these two organizational populations. Consistent with Hypothesis 3, β_3 is greater than 0 and γ_3 is less than 0. Organizations founded in periods of high competitive intensity experienced higher initial death rates. But as they aged, survivors of this initial trial by fire experienced lower death rates than organizations founded in periods of lower competitive intensity. The trial-by-fire hypothesis is further supported in the more inclusive models 4 and 8. Based on the

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[4] I did not model the effects of density at founding and competitive intensity at founding together because these two variables are highly correlated in both organizational populations (Pearson $r = .69$, $p < .0001$, U.S. breweries; Pearson $r = .94$, $p < .0001$, Argentine newspapers).

TABLE 2
Effects of Competitive Intensity at Founding and Organizational Age on the Mortality Rate of American Breweries and Argentine Newspapers[a]

	Models			
American Breweries[b]	**1**	**2**	**3**	**4**
α_3 (competitive intensity at founding in α vector)		.000059* (.000004)		.00005 (.1277)
β_3 (competitive intensity at founding in β vector)	.000024* (.000001)		.000033* (.000001)	.000033* (.000001)
γ_0 (organizational age)	−.00744* (.00101)	−.01036* (.00111)	−.00147 (.00110)	−.00147 (.00110)
γ_3 (competitive intensity at founding in γ vector)			−.0000009* (.0000001)	−.0000009* (.0000001)
$\Delta\chi^{2c}$	394.22*	296.63*	508.65*	508.65*
df	1	1	2	3

	Models			
Argentine Newspapers[d]	**5**	**6**	**7**	**8**
α_3 (competitive intensity at founding in α vector)		−.00125 (.00089)		−.00033 (.00069)
β_3 (competitive intensity at founding in β vector)	.00316* (.00065)		.00305* (.00065)	.00304* (.00065)
γ_0 (organizational age)	−.3114* (.0277)	−.3650* (.0260)	−.2439* (.0320)	−.2467* (.0327)
γ_3 (competitive intensity at founding in γ vector)			−.00025* (.00009)	−.00023* (.00009)
$\Delta\chi^{2c}$	23.92*	2.37	33.06*	33.30*
df	1	1	2	3

[a] Standard errors are in parentheses. Competitive intensity at founding is calculated as the sum of ages of living competitors in the year of founding.

[b] The baseline mortality rate model for American breweries includes the following covariates: organizational age, contemporaneous density and its square, foundings in the previous year, a dummy variable for operating without a permit, failures in the previous year, a dummy variable for founded in 1874, and a dummy variable for years immediately prior to any federal or state prohibition.

[c] Relative to baseline model.

[d] The baseline mortality rate model for Argentine newspapers includes the following covariates: organizational age, contemporaneous density and its square, age of population, foundings in the previous year and its square, and failures in the previous year and its square.

* $p < .05$

estimates in model 3, breweries founded in the period of highest competitive intensity (46,168 organization-years) had an initial mortality rate that is 3.7 (4.491 divided by 1.214) times the initial mortality rate of breweries founded in the mean-competitive-intensity period (5,978 organization-years). But beyond the age of 36 years, breweries founded under conditions of the highest competitive intensity actually experienced lower death rates than breweries founded under conditions of mean competitive intensity. In the case of Argentine newspapers, using estimates from model 7, I found that organizations founded in the environment with the highest competitive intensity (1,280 organization-years) had an initial mortality rate that was 18.6 (37.414 divided by 2.008) times the initial mortality rate of organizations founded in the mean-competitive-intensity environment (280 organization-years). But survivors of this initial trial-by-fire experience had lower mortality rates beyond the age of 11 years.

Political Turmoil at Founding

Table 3 presents coefficient estimates of the effects of political turmoil at founding on the organizational mortality rate of Argentine newspapers. None of the hypotheses are supported. Instead, I found that the mortality rates for organizations founded in periods of political turmoil actually increased with age. Given the transitory nature of political turmoil, this result is not entirely surprising, likely reflecting an increase in political stability over time, as organizations founded in political turmoil age. These organizations are less likely to survive under conditions of political stability since they often have explicit political purposes that may become redundant once the political crisis is resolved.

DISCUSSION

In this study, I compared alternative specifications of the effects of adverse environmental conditions at founding on organizational mortality rates. For this purpose, I used data from two organizational populations—American breweries and Argentine newspapers. First, I assumed that ad-

TABLE 3
Effects of Political Turmoil at Founding and Organizational Age on the Mortality Rate of Argentine Newspapers[a,b]

	Models			
Variables	1	2	3	4
α_3 (political turmoil at founding in α vector)		.5551		.2746
		(.3834)		(.4428)
β_3 (political turmoil at founding in β vector)	−.0184		−.1292	−.1313
	(.0720)		(.0840)	(.0845)
γ_0 (organizational age)	−.3700*	−.3686*	−.4058*	−.4013*
	(.0260)	(.0261)	(.0314)	(.0320)
γ_3 (political turmoil at founding in γ vector)			.1255*	.1149*
			(.0474)	(.0513)
$\Delta\chi^{2c}$	0.07	1.94	6.38*	6.75
df	1	1	2	3

[a] Standard errors are in parentheses.

[b] The baseline mortality rate model for Argentine newspapers includes the following covariates: organizational age, contemporaneous density and its square, age of population, foundings in the previous year and its square, and failures in the previous year and its square.

[c] Relative to baseline model.

* $p < .05$

verse founding conditions would have a constant and unchanged adverse effect on the survival probability of organizations. In other words, adverse founding conditions were expected to have positive effects on the asymptotic death rate of organizations. I found little or no support for this specification of the effect of adverse founding conditions on organizational mortality rates.

Second, following Carroll and Hannan (1989), I assumed that adverse founding conditions would primarily increase the initial mortality rate. Though the mortality rate models supported this specification, they provided even greater support for a third specification in which I assumed that organizations born in high-adversity environments undergo a trial by fire. Organizations founded in high-adversity environments experienced much higher initial mortality rates than organizations founded in low-adversity environments. This result is consistent with the predictions of the resource scarcity argument. But survivors of this initial trial by fire may prove to be stronger competitors, perhaps because weaker, or high-frailty, organizations fail in larger numbers when subjected to adverse environmental founding conditions, leaving behind a surviving cohort of stronger, or low-frailty, organizations. In addition, the failure of large numbers of organizations founded in high-adversity environments may engender a considerable degree of collective learning at the cohort level—it is more likely that survivors in such cohorts will develop recipes for success (Levitt & March, 1988: 329–332). The trial-by-fire interpretation received strong support in both organizational populations examined in this study, American breweries and Argentine newspapers. These effects are played out over the long term: with increasing age, organizations founded in high-adversity environments actually experience a lower death rate than those founded in comparatively low-adversity environments. However, the estimated time lag involved in this process differs both by type of founding condition and by organizational population. In general, the mortality rate crossover point is reached at an earlier age by Argentine newspapers than by American breweries, suggesting a more severe trial by fire in the newspaper population.

The use of secondary data imposes serious limitations on the scope of this study. Nevertheless, the study's results raise at least two unanswered questions that need to be addressed in future research. First, though I found support for the trial-by-fire hypothesis, I was unable to differentiate between the two plausible mechanisms driving the process: unobserved heterogeneity in organizational frailty and population-level learning. How can variations in organizational frailty and population level learning be more directly accounted for? Second, the effect of political turmoil at founding on organizational mortality rates is contrary to the predictions of the trial-by-fire model—mortality rates continued to increase with age for organizations founded in periods of political turmoil. Is there a more general explanation for this surprising result?

Variations in initial resources or endowments of organizations likely account for differences in organizational frailty. Brüderl and Schüssler

(1990) argued that organizations face a period of zero mortality risk immediately following their founding because they can live off their stock of initial resources (cf. Brüderl, Preisendörfer, & Ziegler, 1992). The greater the initial resources of a firm, the longer this period of "adolescence" and the lower the peak death rate (Levinthal & Fichman, 1988). The death rate reaches a peak soon after the period of adolescence is over and continuously declines thereafter. Aggregation of individual death rate patterns of this type leads to an inverted U-shaped relationship between organizational age and mortality at the population level. Brüderl and Schüssler's (1990) study of mortality among all business organizations in Munich and Upper Bavaria over the period 1980–89 suggested that larger organizations and those with a commercial legal form experienced a longer period of adolescence and a lower peak death rate. Fichman and Levinthal (1991) proposed a similar model with one significant difference—instead of assuming an initial period of zero mortality risk for individual organizations, they assumed that the individual organizational mortality rate rose during the period of adolescence, reached a peak, and then declined (cf. Levinthal, 1991; Levinthal & Fichman, 1988). Such a pattern at the individual organizational level is attributed to the existence of limited foresight on the part of both organizational members and external groups that withdraw support to losing endeavors, thus accelerating their demise. The role of initial endowments, however, is consistent in both formulations of the liability of adolescence. Initial endowments act as resource buffers that prolong the period of adolescence and lower the peak mortality rate for individual organizations.

Organizations founded under adverse environmental conditions are likely to have lower stocks of initial resources. If organizational inheritance patterns are path-dependent, the liabilities resulting from lower levels of initial resources can become self-reinforcing (Arthur, Ermoliev, & Kaniovski, 1987). Levinthal and Myatt's (1995) study of custodian and transfer agent choice by mutual funds provides evidence for such feedback effects of initial resources on organizational performance. Levinthal and Myatt found that the greater the initial market share of custodians and transfer agents in the mutual fund industry, the more likely they were to be chosen as processors by a mutual fund company. According to the liability of adolescence argument, the adolescence period for organizations with fewer initial resources should be shorter and the peak death rate higher. Organizational mortality then falls from this peak level as organizations age. Organizations founded under favorable environmental conditions are likely to have greater initial resources, longer periods of adolescence, and a lower peak death rate, but their mortality rate does not decline to that of organizations founded under adverse environmental conditions. Research on new firm formation and performance has examined a wide variety of initial conditions that determine the availability of and competition for resources, which in turn account for the differential success of entrepreneurs (Cooper & Gimeno-Gascon, 1992). Prominent among these initial conditions are the human capital of individual entrepreneurs, the social capital implicit in the external networks of entrepreneurs, the financial (venture) capital of start-up firms, and industry structure. Population-level studies of the link between founding conditions and organizational mortality rates require that analysts be able to collect such data on all organizations within a population over an extended period of time. In this study, I examined two founding conditions related to industry structure, the number of competitors and the cumulative experience of competitors. Future research could examine whether a measure of initial resources such as organizational size, generic technological capability, or accumulated experience in a related technical or product-market subfield interacts with environmental founding conditions to affect organizational mortality.

In adverse environmental conditions, population-level learning implies that surviving organizations selectively copy successful organizational routines from the large number that fail. This limitation is more likely to occur in organizational populations with a high degree of competitive interaction. Chen and MacMillan (1992) analyzed competitive moves among 32 U.S. airlines between 1979 and 1986. They found that matching competitive responses were more likely to occur when firms were dependent upon a particular market. Their results suggest that the transfer of organizational routines between competing organizations is more likely when there is a high degree of overlap in the market niches served by individual organizations. Data on competitive and other interorganizational interactions within a population can help identify factors that influence the rate of population-level learning.

Institutional theorists suggest that organizations often change in ways that mimic legitimate or successful organizations (DiMaggio & Powell, 1983). For example, Haveman (1993) found that savings and loan organizations followed diversification strategies that resembled those of successful firms within the industry. Under adverse environmental conditions, the incidence of success among firms is likely to be rare and consequently more visible to potential imitators. In other words, entrepreneurial behavior among firms founded in adverse environments is likely to involve imitative search (Lant & Mezias, 1990: 149–150).

Collective action among organizations, often initiated in response to adverse environmental conditions, likely contributes to population-level learning.[5] It is interesting to note in this regard that in both the American brewery population and the Argentine newspaper population, industry associations and cooperatives were formed during periods featuring high density and high competitive intensity. In the American brewing industry, these attempts at collective action occurred in response to a perceived competitive threat from foreign liquor interests (Baron, 1962). In the Argentine newspaper industry, newspapers established during the comparatively stable period of the Rosas dictatorship enjoyed a longer life expectancy (Carroll, 1987: 135). These newspapers were sponsored by the Rosas regime and had common political goals. The increased probability of collective learning among cohorts of organizations founded in adverse environmental conditions may result in a sharper drop in organizational mortality after the initial period of adolescence.

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[5] Environmental adversity is linked not only to intense competition but also to legitimacy constraints, particularly in emerging industries. Aldrich and Fiol (1994) developed several propositions linking collective strategies within industries to the acquisition of cognitive and sociopolitical legitimacy.

Previous ecological research suggests that ties to powerful institutional actors reduces organizational mortality rates. Baum and Oliver's (1991, 1992) studies of organizational mortality among Toronto child care service organizations showed that both purchase of service agreements with the Municipality of Toronto Children's Service Division and site-sharing agreements with established community institutions improved the survival chances of the studied organizations. These results are plausible when the institutional environment is stable. The effects of political turmoil on the mortality rate of Argentine newspapers suggest, however, that the existence of institutional links at founding may be detrimental to organizational survival when the institutional environment is subject to discontinuities. Newspapers founded in periods of political turmoil are often linked to political parties and other institutional actors whose fortunes wax and wane with changes in political regimes. Newspapers linked to institutional actors who decline in importance as a result of political turmoil are likely to fail at higher rates as they age.[6] In other words, an organization's institutional embeddedness at founding can be thought of as an initial resource subject to feedback effects. In stable institutional environments, an organization's institutional embeddedness at founding lowers its mortality risk to a greater extent as it ages and ties to influential institutions lengthen in duration. In the presence of institutional discontinuities, however, an organization's institutional embeddedness at founding increases its resistance to change and thus raises its mortality risk as it ages and its ties to institutions that are no longer influential grow older. Future research could investigate the existence of feedback effects of institutional embeddedness at founding on organizational mortality in the context of institutional discontinuities such as changes in political regimes, the lowering of trade barriers, and the deregulation of industries.

This study illustrates the value of incorporating population-level analyses into the study of entrepreneurship and market entry (Aldrich & Wiedenmayer, 1993). The results suggest that the effects of environmental founding conditions vary over the organizational life cycle in counterintuitive ways.

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[6] Miner and colleagues (1990) found that Finnish newspapers with links to political parties during a period of civil war suffered higher mortality rates than newspapers without such links. These data may offer a unique opportunity to examine the impact of institutional linkages at founding on organizational mortality.

Adverse environmental conditions at founding increase the initial risk of organizational mortality, but survivors of this trial by fire actually suffer lower mortality rates in the long run. The trial-by-fire model suggests that entrepreneurs or diversifying entrants with a large stock of initial resources may find it advantageous to enter an industry or a product-market when competition is severe. An interesting policy implication of the trial-by-fire model relates to the role of nation-states in protecting infant industries. Several countries have instituted policies that promote the founding and early survival of business organizations in targeted industrial sectors. Such policies, if implemented indiscriminately, run the risk of inadvertently leading to the survival of a greater proportion of frail organizations, thus lowering overall country competitiveness. The study also opens up new areas for ecological research on organizational mortality, in particular work on disentangling the effects of unobserved heterogeneity in organizational frailty and population-level learning and investigations of possible feedback effects of an organization's institutional embeddedness at founding. Further research along the lines suggested above would allow these issues to be addressed.

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TOWARD AN INSTITUTIONAL ECOLOGY OF ORGANIZATIONAL FOUNDING

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In this study, we demonstrate how the ecological and institutional characteristics of organizational niches affect the likelihood of organizational foundings. We describe and measure key ecological, institutional, organizational, and spatial properties of organizational niches. Our theoretical framework emphasizes how the effects of ecological and institutional processes vary both within and between nonprofit and for-profit sectors and across levels of geographic aggregation. An analysis of day care center founding in Metropolitan Toronto supports our main theoretical expectations. Thus studying multiple dimensions independently and interactively provides a richer, more comprehensive treatment of the context of organizational founding.

Organizational founding involves mobilizing resources in pursuit of environmental opportunities. An organization's founders must strategically select an organizational niche, defined by organizational resource requirements and product capabilities, that targets a specific line of products or services for a selected set of customers in a particular geographic location (Baum & Singh, 1994a). These choices, which affect the likelihood that organizing attempts will result in successful foundings, depend on the attributes of the socioeconomic setting in which the organization emerges (Stinchcombe, 1965). Consequently, ecological and institutional influences on the creation of new organizations have been a key theme in recent research (for reviews, see Aldrich and Wiedenmayer [1993] and Baum [1996]).

Ecological and institutional approaches to organizational founding stress economic and social contextual factors that produce variations in temporal patterns and rates of founding (Aldrich & Wiedenmayer, 1993). Ecological approaches emphasize how competition for scarce common resources (Hannan & Freeman, 1977; McPherson, 1983) and mutualism based on complementary functional differences (Barnett, 1990; Fombrun, 1986;

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Hawley, 1950) lead to differential selection of organizational founding attempts in a population. Institutional approaches focus on how legitimacy, social support, and approval from external constituents increase the likelihood that an organization can be successfully created (Meyer & Rowan, 1977; Scott, 1995). Institutional legitimacy facilitates resource acquisition, elevates the status of emerging organizations in the community, and deflects questions about organizations' rights and abilities to provide specific products or services (DiMaggio & Powell, 1983; Hannan & Carroll, 1992; Oliver, 1991). Although the general themes of the ecological and institutional perspectives on organizational founding are distinct, they share a common focus on the collective organization of environments. Institutional theorists emphasize the cultural and normative framework within which populations are embedded; ecologists examine the more specific effects of competition and legitimation processes on population dynamics (Hannan & Carroll, 1992; Scott, 1995).

The present research draws on ecological and institutional perspectives to show how socioeconomic context affects founding rates. Specifically, we show how the ecological and institutional characteristics of organizational niches affect the likelihood of organizational foundings. We describe and measure key ecological, institutional, organizational, and spatial properties of organizational niches. By studying these organizational niche dimensions independently and interactively, we provide a richer, more comprehensive treatment of the context of organizational founding.

In this approach to ecological processes (cf. Baum & Singh, 1994a, 1994b, 1996), we conceive each member of a population as occupying a potentially unique organizational niche that delineates its location in a multidimensional resource space. The organizational niche, which is defined by the intersection of resource requirements and productive capabilities at the organization level, depends on where an organization is located and what it does (for instance, the clients it has the capacity to target, how it responds to its environment). The organizational niche is a result, not a cause, of organizational adaptation—it is "carved out." Thus, the organizational niche is a dynamic concept.[1] Depending on the particular organizational niches they target, organizations encounter different competitive landscapes. In past work, we emphasized two features of organizations' competitive landscapes, overlap density and nonoverlap density. The overlap density of an organization is the aggregate of the resource overlaps of its organizational niche with those of all other population members. Nonoverlap density is the aggregate of the absence of overlaps. By defining the internal structure of population niches, overlap and nonoverlap densities help to isolate competitive and noncompetitive forces within a population.

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[1] The organizational niche concept is related to the concepts of organizational domain in organization theory and domain similarity in the literature on interorganizational relationships. Organizational domain refers to the claims organizations stake for themselves in terms of the clients they serve, the goods and services they produce, and the technology they employ (Haveman, 1993). Domain similarity refers to the extent to which organizations obtain their money from the same sources, have the same goals, have staff with the same professional skills, and provide the same kind of services to the same kind of customers (Van de Ven, 1976).

In our approach to institutional processes (Baum & Oliver, 1992), we emphasize how institutional embeddedness influences a population's sociopolitical legitimacy by signaling its conformity to social and institutional expectations (Aldrich & Fiol, 1994; Meyer & Rowan, 1977). Institutional embeddedness refers to connections between a population and its institutional environment (DiMaggio & Powell, 1983; Fombrun, 1986, 1988). We operationally define institutional embeddedness as relational density, or the number of formal relations between the members of a population and key institutions in the population's environment. Key institutions refer to government agencies and community organizations. Since contemporary organizational populations rarely operate in isolation from state and societal pressures, influences of institutional embeddedness on population dynamics tend to be pervasive (Meyer & Rowan, 1977; Reddy & Rao, 1990; Zucker, 1987).

Previous research on day care centers (DCCs) in Metropolitan Toronto yielded evidence that overlap density, nonoverlap density (Baum & Singh, 1994a, 1994b), and relational density (Baum & Oliver, 1992) affected founding and failure rates significantly. The present study extends this work in several ways.

First, we introduce the concept of organizational niche differentiation. We use this concept, which refers to the degree of resource nonoverlap between potential competitors, to examine whether the potential for competition between organizations in overlapping organizational niche segments fosters cooperation between them in other, nonoverlapping segments. Thus, we investigate how organizational niche differentiation influences the potential for stable coexistence among potential competitors with overlapping organizational niches. We measure organizational niche differentiation as nonoverlap intensity, which we define as the sum of the ratios of organizational niche nonoverlaps to overlaps between a focal organization and all potential competitors in the population. High nonoverlap intensity signifies a high degree of differentiation between a focal organization and its competitors; low nonoverlap intensity signifies a low degree of differentiation of resource needs between a focal organization and its competitors. Addition of this measure elaborates our original organizational niche overlap model by capturing a basic feature of ecological relationships in a multidimensional resource space: the interaction between competitive and noncompetitive dimensions of interorganizational relations that commonly occur at the same time.

Second, we expand our concept of organizational niche to include differences in the competitive orientations and social legitimacy of organizations in nonprofit and for-profit sectors in order to add a behavioral dimension to our operational definition of organizational niche. We investigate the possibility that, because of these differences, organizational niche overlap will more strongly influence foundings in the for-profit sector, and organizational niche nonoverlaps, organizational niche differentiation, and institutional embeddedness will more strongly influence foundings in the nonprofit sector. We also examine how ecological and institutional processes in one sector affect the founding rate in the other, proposing that ecological and institutional processes in the nonprofit sector will strongly influence organizational foundings in the for-profit sector. A test of the within- and cross-sector influences of ecological and institutional processes on nonprofit and for-profit foundings builds on DiMaggio and Anheier's (1990) point that an ecological approach is required to understand the level of activity in nonprofit sectors and the influence of important behavioral differences between nonprofits and for-profits.

Third, past work has shown substantial variation in the strength of ecological processes at different levels of analysis (Baum & Singh, 1994a, 1994b, 1996). Here, we extend the examination of level of analysis to institutional processes as well. The choice of level of analysis is substantive: it sets spatial boundaries on the underlying competitive and institutional processes that affect founding rates (Singh, 1993). Our theoretical expectations were that organizations will be influenced more strongly by ecological processes in local geographic arenas and that the effects of institutional embeddedness will be felt most strongly within the geographic or political jurisdiction of the institutional population's actors. If ecological and institutional processes are specific to particular geographic areas, it is crucial to define the level of geographic aggregation correctly to avoid misspecifying these processes (Lomi, 1995; Singh, 1993).

Taken together, these elaborations of earlier work permit finer-grained specifications of the ecological and institutional processes underlying key entrepreneurial decisions at the time of organizational founding. Our concern with organizational niche differentiation emphasizes how interactions between organizations' resource overlaps and nonoverlaps act to facilitate stable coexistence among potential competitors in a multidimensional organizational niche space. Our focus on profit orientation broadens our original conception of organizational niche to include a behavioral dimension; organizational niches are defined here both by where organizations are located and how they are expected to behave within the resource space. And, finally, our examination of spatial boundaries clarifies the level of analysis at which ecological and institutional processes influence the behavior of organizational founders.

THE INSTITUTIONAL ECOLOGY MODEL

Ecological Processes: Organizational Niche Overlap, Nonoverlap, and Differentiation

In organizational ecology, the potential for competition among organizations is viewed as being primarily a function of similarity in resource requirements: the more similar the resource requirements, the greater the potential for competition (Hannan & Freeman, 1977, 1989; McPherson, 1983, 1990). At one extreme, organizations occupying the same organizational niche (that is, organizations with the same resource requirements) are perfect competitors. At the other extreme, organizations with distinct resource requirements do not compete. In general, the potential for competition between any two organizations is proportional to the overlap of their organizational niches. More formally, the potential for competition between two organizations i and j can be represented by an *organizational niche overlap weight,* w_{ij}, that varies between 0 (no overlap in resource requirements and no potential for competition) and 1 (complete overlap in resource requirements and a high potential for competition) (McPherson, 1983). The resource overlap weight, w_{ij}, gives the potential competition experienced by organization i resulting from the presence of organization j and is equal to the proportion of the resources required by i that j also requires.

Overlap and nonoverlap densities. Studying levels of organizational niche overlap and nonoverlap between organizations provides a way to separate competitive and noncompetitive forces within an organizational population (Baum & Singh, 1994a, 1994b, 1996). Consequently, choice of organizational niche, together with the distribution of competitors and noncompetitors, may impact founding probabilities significantly (Baum & Singh, 1994a). To measure the potential competition faced by an organization, we define the variable overlap density (Baum & Singh, 1994a, 1994b, 1996), which is the aggregate of the organizational niche overlaps of the focal organization with those of all other members of its population. More formally, the overlap density for an organization in organizational niche i at time t is given by:

$$\textit{Overlap Density}_{it} = N_{it} + \sum_{j \neq i} w_{ij} N_{jt}, \tag{1}$$

where N_{it} is the number of population members in organizational niche i at time t, N_{jt} is the number of organizations in organizational niche j at time t, and w_{ij} is the organizational niche overlap weight for organizations in organizational niche i with those in organizational niche j.

Overlap density has a complement, nonoverlap density (Baum & Singh, 1994a, 1994b, 1996), the aggregate of the resource nonoverlaps. It is an estimate of the number of organizations whose resource requirements do not overlap with those of the focal organization. Thus, overlap and nonoverlap densities disaggregate competitive and noncompetitive forces for each organization in a population with respect to underlying resources. More formally,

$$\textit{Nonoverlap Density}_{it} = N_t - \left[N_{it} + \sum_{j \neq i} w_{ij} N_{jt} \right], \tag{2}$$

where N_t is the population density at time t.

Our theoretical argument is that the degrees of organizational niche overlap and nonoverlap influence the probability and success of organizational founding attempts. Depending on the organizational niches they target, organizational founders face different competitive landscapes. The number of organizations already occupying the same organizational niche affects the potential for competition. Founding attempts in organizational niches that are more crowded should be both less numerous and less likely to succeed than those in less crowded parts of a resource space. Thus, high overlap density implies greater competition for resources; competition for resources can influence the probability of founding by, for example, making it difficult for some entrepreneurs to attract sufficient resources.

In comparison, founding attempts in organizational niches that are relatively highly differentiated from other organizational niches will be both more frequent and have a higher likelihood of success than founding attempts in a less differentiated part of a resource space. According to Hawley (1950: 201–203), competition for finite resources between organizations inhabiting similar niches eventually leads to differentiation. Firms become differentiated as competitive pressures push less fit competitors out of the market. Losing firms are transformed either through territorial or functional differentiation by entrepreneurs seeking out distinct functions in which they hold a competitive advantage. Differentiation lowers the intensity of competition by reducing the number of firms in direct competition for underlying resources: it lowers the degree of organizational niche overlap. Research has clearly shown that differentiation segmenting or separating the resource requirements of organizations reduces or eliminates the potential for competition between them (Barnett & Carroll, 1987; Baum & Mezias, 1992; Delacroix, Swaminathan, & Solt, 1989). In addition to reducing the potential for competition, differentiation can also lead to the creation of new organizations that play roles complementary to those of established organizations in a population. In this way, competition can result in the emergence of a complex system of functionally differentiated organizations linked by mutualistic interdependencies. Hawley (1950: 209) described two distinct bases for mutualism: commensalism, defined as positive interdependence based on supplementary similarities (for instance, similar organizations work together to enhance each other's legitimacy), and symbiosis, defined as positive interdependence based on complementary differences (for instance, organizations with different capabilities cooperate directly or transact in markets to the benefit of both). Thus, organizations that occupy nonoverlapping organizational niches may have different capabilities that lead them to possess complementary resources they can exchange, or they may provide complementary products or services that enhance each other's demand. For example, day care centers licensed to enroll infants may create future demand for those licensed to enroll toddlers, or they can cooperate directly by referring potential clients to each other.

Hawley's view suggests that entrepreneurs will attempt to limit potential competition by distinguishing their new ventures from other organizations in their population. In particular, his arguments imply that in a competitive environment, nonoverlap density will stimulate foundings because it signals the presence of a differentiated organizational niche in which organizations can fulfill complementary roles. Each can be dependent on, but noncompetitive (and potentially cooperative) with, other organizations. Thus, although fear of competition discourages founders from entering organizational niches where overlap density is high, the benefits of differentiation and complementarity pull them into those where nonoverlap density is high. Therefore, following Baum and Singh (1994a), we offer

> *Hypothesis 1a: Overlap density is negatively related to the founding rate in an organizational population.*
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> *Hypothesis 2a: Nonoverlap density is positively related to the founding rate in an organizational population.*

Nonoverlap intensity. To this point, we have characterized the effects of organizational niche overlap and nonoverlap exclusively in absolute terms, that is, in terms of the presence and absence of resource overlaps. Research suggests, however, that under some circumstances, the potential for competition can facilitate stable coexistence. For example, the basic point of the multipoint competition literature (e.g., Barnett, 1993; Baum & Korn, 1996; Bernhein & Whinston, 1990) is that the outcome of a history of competitive interaction between two firms that meet each other in multiple product, client, or geographic markets may be a reduction in the vigor of their competitive interactions in the markets in which they meet and increased stability and predictability of their competitive interactions.

Our interest is in understanding forces that diminish the level of competition between organizations. Thus, like researchers investigating multipoint competition, we are interested in how competition can facilitate coexistence among potential competitors. To examine whether the potential for interorganizational cooperation is strengthened when it is combined with an element of competition, we extend the organizational niche overlap model to consider the relative influences of organizational niche overlap and nonoverlap. Organizational niche differentiation, which we measure as nonoverlap intensity, refers to the degree of resource nonoverlap among potential competitors. Nonoverlap intensity is defined as the sum of an organization's ratios of organizational niche nonoverlaps to overlaps with all other potentially competing population members. More formally, the nonoverlap intensity for organizations in organizational niche i at time t is given by:

$$\mathit{Nonoverlap\ Intensity}_{it} = \sum_{j \neq i} k_{ij} M_{jt}, \ \mathit{for\ all}\ j\ \mathit{where}\ w_{ij} > 0, \tag{3}$$

where k_{ij} are the ratios of organizational niche nonoverlap to overlap between organizational niche i and all organizational niches j for which the organizational niche overlap (w_{ij}) with organizational niche i is more than 0, and M_{jt} is the number of organizations in organizational niche j at time t. High values of k_{ij} (and thus of nonoverlap intensity, which is the sum of an organization's k_{ij}'s) denote relationships between organizations characterized more by organizational niche nonoverlap than by overlap.

In contrast to overlap density and nonoverlap density—separate aggregates of the total overlaps and nonoverlaps of a focal organization with every other organization in a population—nonoverlap intensity is the aggregate of the focal organization's ratios of organizational niche nonoverlap to overlap with each other organization in the population. Thus, although the two density variables treat organizational niche overlap and nonoverlap as distinct properties of an organization's relationships with other organizations in its population and aggregate them separately, the intensity variable treats them as fundamentally interrelated and aggregates them simultaneously. This measure elaborates past work by permitting us to examine a basic feature of ecological relationships in a multidimensional resource space: organizations are commonly competitive and noncompetitive at the same time, and this duality may affect the potential for cooperation and coexistence among them.

Our operational definition of organizational niche differentiation, nonoverlap intensity, measures the degree of nonoverlap in resource needs among partially overlapped competitors (i.e., $1 > w_{ij} > 0$). A low degree of organizational niche differentiation (low nonoverlap intensity) suggests competitive effects between organizations because they share common resource needs. A high degree of differentiation (high nonoverlap intensity) indicates the potential for facilitative or cooperative relations among organizations with overlapping niches. High differentiation provides both incentives and opportunities for noncompetitive activities among organizations. Recognizing their potential for competition, organizations occupying partially overlapping niches may be more motivated to cooperate. Under such conditions, organizations can avoid intense competitive interactions by adopting a live-and-let-live strategy in overlapping organizational niche segments or by cooperating through joint problem solving, information exchange, or client sharing in nonoverlapping organizational niche segments (Van de Ven, 1976). The contact between organizations with partially overlapped organizational niches facilitates the formation of such cooperative agreements (either implicit or explicit) between them by increasing their knowledge about each other (Oliver, 1991). Therefore, we predict that high organizational niche differentiation (high nonoverlap intensity) will reduce the potential for competition and increase the potential for cooperation and therefore encourage foundings.

> *Hypothesis 3a: Nonoverlap intensity is positively related to the founding rate in an organizational population.*

Institutional Processes: Institutional Embeddedness

Although population density researchers acknowledge the importance of a population's relations to its institutional environment (Hannan & Carroll, 1992), density-dependence researchers have not typically investigated the influence of these relations on foundings and failures directly (Baum &

Powell, 1995; Zucker, 1989). Further, when ecological researchers have examined institutional effects, they have typically been modeled in terms of variations over historical periods rather than in terms of direct institutional ties (Baum, 1996). However, when a population has extensive relations with community and government actors, these institutions can exert considerable influence over the population and the conditions that regulate competition for scarce resources and legitimacy (Baum & Oliver, 1992). According to institutional theory, conformity to the norms and social expectations of the institutional environment improves an organization's survival chances significantly (Meyer & Rowan, 1977; Oliver, 1991; Scott & Meyer, 1983). When organizations establish ties to reputable societal institutions, they typically obtain benefits that contribute to their likelihood of survival. These benefits include greater legitimacy and status (Baum & Oliver, 1991; Scott & Meyer, 1983; Singh, House, & Tucker, 1986), and enhanced resource accessibility and predictability (Aldrich & Auster, 1986; Miner, Amburgey, & Stearns, 1990; Pfeffer & Salancik, 1978). Thus, the endorsement of an organization's practices by a community or state agency increases the organization's legitimacy and enhances its ability to attract clients and resources (Wiewel & Hunter, 1985).

Organizational population growth is typically accompanied by increasing institutional embeddedness (Baum & Oliver, 1992; Zucker, 1987). As a population grows and its social or public impact becomes more widely recognized, community advocacy groups, government agencies, professional associations, and other social actors take an increasingly active role in monitoring population members' activities, distributing endorsements and rewards, and shaping the rules and standards about what are legitimate activities and outputs for the population (Baum & Oliver, 1992). Institutional theorists predict that this increasing interconnectedness between a population and its institutional environment enhances the growth and survival of the population over time (Scott & Meyer, 1983). For example, Meyer and Rowan suggested that "the long-run survival prospects of organizations increase as state structures elaborate and as organizations respond to institutionalized rules . . . schools, hospitals, and welfare organizations show considerable ability to survive, precisely because they are . . . almost absorbed by their institutional environments" (1977: 352). Organizational ecologists agree that such state and community involvement in the activities of a population can improve a population's chances for survival and growth by increasing the capacity of its members to mobilize resources and legitimacy (Hannan & Carroll, 1992: 41).

To measure the institutional embeddedness of an organizational population, we defined a variable, relational density, which is the number of formal relations between the members of a population and key institutions in the population's environment (Baum & Oliver, 1992). Key institutions refer to government agencies and community organizations in a population's environment. Our theoretical argument is that the degree of institutional embeddedness influences the probability of organizational founding.

As relational density increases during the initial phase of a population's growth, we predict an increase in the founding rate. The possibility of developing ties to the institutional environment helps foster the creation of new organizations by making the conditions of entry more attractive to potential founders because institutional relations provide social support, legitimacy, and resources (Oliver, 1988; Reddy & Rao, 1990; Scott, 1987). Many connections between a population and its institutional environment (high relational density) also mean the population is perceived as highly isomorphic with normative expectations and therefore as highly worthy of support (DiMaggio & Powell, 1983; Meyer & Rowan, 1977). As a result, even founders without institutional ties may increase their chances of establishing organizations by becoming members of a more credible population. With higher levels of relational density, however, more intense competition develops among organizational founders for access to limited institutional resources and endorsements, suppressing the rate of founding. Thus, at high levels of relational density, when a population's existing institutional relations are dense and well established, difficulties in gaining access to and acceptance in an established institutional network are expected to depress the creation of new organizations. Therefore, following Baum and Oliver (1992), we propose:

> *Hypothesis 4a: Relational density has an inverted U-shaped relation to the founding rate.*

ELABORATING THE MODEL: PROFIT ORIENTATION AND LEVEL OF ANALYSIS

To this point, we have characterized the distribution of founding opportunities in an organizational population as a function of four environmental processes: organizational niche overlap, nonoverlap, and differentiation, and institutional embeddedness. Implicit in our arguments is the view that these processes operate homogeneously within organizational populations. However, theory and research suggest that ecological and institutional processes are likely to vary systematically across the nonprofit and for-profit sectors of a population (DiMaggio & Anheier, 1990) and across different levels of spatial aggregation (Hannan & Freeman, 1992; Lomi, 1995; Singh, 1993). Therefore, we now incorporate these sources of heterogeneity within our institutional ecology model by (1) identifying differences in the strengths of the effects of these processes on organizational foundings in the nonprofit and for-profit sectors of a population, (2) characterizing cross-sector effects of ecological and institutional processes in one sector on the rate of founding in the other, and (3) specifying the levels of analysis at which ecological and institutional processes will operate most strongly.

Ecological and Institutional Processes in Nonprofit and For-Profit Organizational Sectors

Recent institutional theorizing emphasizes that ecological and institutional processes are relevant to both nonprofit and for-profit sectors (DiMaggio & Anheier, 1990; Powell, 1991). Just as nonprofit organizations must engage in vigorous competition for resources, status, and clients, institutional forces influence the framework for competition in private sectors (Barnett & Carroll, 1993; Friedland & Alford, 1991; Powell, 1991; Reddy & Rao, 1990). In this study, therefore, we propose that ecological and institutional processes will have significant effects on founding rates in both the nonprofit and for-profit sectors of a population. However, we expect the force of ecological and institutional processes to vary by sector. Below, we develop three bases—competitive orientation, social legitimacy, and the social legitimacy of institutional linkages—for these differences and then advance hypotheses linking them to the four key variables in our institutional ecology model.

Competitive orientation. In the for-profit sector of a population, competition is more salient (DiMaggio & Anheier, 1990; Hansmann, 1980), and for-profits' performance and survival depend more fundamentally than nonprofits' on profit potential and competitive vitality. Consequently, for-profits and their founders tend to be more attentive to, and more influenced by, the structure of market opportunities and competition (Hansmann, 1980; Perry & Rainey, 1988; Rose-Ackerman, 1988). Nonprofits and their founders, in contrast, are typically viewed as more oriented toward community responsiveness, noncompetitive behavior, cooperative activities, social image, and the fulfillment of social needs (DiMaggio & Anheier, 1990; Hansmann, 1980; James, 1989). Nonprofits also attend more to the cultural aspects of their environments and the networks of consensus and meaning that affirm or endorse their activities (Baum & Oliver, 1991; Hansmann, 1987). Thus, in nonprofit sectors a normative impetus away from competition often prevails (Halliday, Powell, & Granfors, 1987). Therefore, nonprofits' founding decisions will be influenced by the availability of social support and resources from the institutional environment surrounding them more than will for-profits' founding decisions. Consistent with this view, in the child care sector, local image and community relations strongly influence nonprofits' survival (Baum & Oliver, 1991), and for-profits are far more growth-oriented than nonprofits (Baum & Mezias, 1993).

Social legitimacy. Nonprofits may not typically engage in vigorous rivalry, but in the industries in which they arise, nonprofits may nevertheless be formidable competitors as a result of their high social legitimacy. Nonprofits typically develop in areas in which trustworthiness is important and consumers cannot evaluate the quality of services because those services are complex or defy monitoring, or because the beneficiaries (for instance, children at a day care center) are unreliable witnesses to service quality (Hansmann, 1980). Under these conditions, the cultural environment tends to define service quality, and nonprofits are seen as ideologically and operationally distinct from and superior to for-profits (DiMaggio & Anheier, 1990). The absence of a profit motive is expected to lead nonprofits to provide trustworthy services, but entrepreneurs preoccupied with profits are often charged with downgrading service quality (James, 1989). Such indictments may turn nonprofit status into a distinctive competitive advantage in the acquisition of, or eligibility for, government funding and community support. They may also constrain for-profits' ability to compete aggressively against nonprofit rivals without damaging their own public image. For these reasons, many view services such as child care as "inappropriate for market exchange or requiring special protection from corruption by the profit motive" (DiMaggio & Anheier, 1990: 137). Indeed, in the child care sector in Canada, the public in general has been increasingly opposed to for-profit care (Maynard, 1985). Supporting the idea that social legitimacy makes for more robust nonprofit competitors, previous research has shown that nonprofit day care centers in Metropolitan Toronto have lower failure rates than their for-profit counterparts (Baum & Oliver, 1991, 1992; Baum & Singh, 1994b).

Social legitimacy of institutional links. The relative social legitimacy of organizations in nonprofit and for-profit sectors derives from external assessments of the degree to which organizations' goals and practices are aligned with prevailing values and beliefs in the institutional environment. However, societal constituents and the general public frequently judge interorganizational relations as well as the organizations that they connect (Baum & Oliver, 1991), and such evaluations may largely determine the ability of institutional relations to contribute to the institutional standing of an organizational population. The ability of institutional links to contribute to a population's institutional standing may depend significantly on whether the links are perceived as legitimate or consistent with normative expectations in the population's environment. Institutional links to governmental, religious, and charitable organizations, for example, are more consistent with nonprofits' "locus of values," embodying voluntarism, altruism, and participation (DiMaggio & Anheier, 1990: 153). For example, as described above, in the child care sector, the nonprofit/for-profit distinction is critical because it reflects organizations' missions, values, and trustworthiness. Nonprofit child care has been increasingly perceived as more legitimate and trustworthy than for-profit care in Canada (Maynard, 1985). As a result, influential child advocacy groups have questioned the formation of links between for-profit organizations and government or community institutions. Because the social validity of these connections is in question, they will be less likely to contribute legitimacy than will links between institutions and day care centers in the more socially acceptable nonprofit sector. More generally, when institutional links are normatively ratified by the wider social environment, they will be more likely to increase organizational legitimacy (Baum & Oliver, 1991), and thus more likely to contribute to the institutional acceptance of organizational populations.

Within-sector difference hypotheses. The foregoing characterization of organizations in nonprofit and for-profit sectors has clear implications for the strength of ecological and institutional processes in each sector. First, because nonprofits' competitive orientation suggests that they will be more inclined than for-profits to seek facilitative or cooperative relations with potential competitors, and be more willing than for-profits to refrain from vigorous competition, we expected that overlap density would have a stronger influence on founding in the for-profit sector of a population, where competitive effects are more salient, and that nonoverlap density and nonoverlap intensity would be more powerful forces in the nonprofit sector, where an ethos of noncompetition, voluntary cooperation, and sharing among potential competitors prevails. Although both nonprofit and for-profit entrepreneurs seek differentiation, nonprofit entrepreneurs' emphasis on noncompetition, cooperation, and resource sharing and for-profit entrepreneurs' emphasis on market opportunities and competition imply very different ways of achieving differentiation. By seeking out opportunities for cooperation and resource sharing, nonprofit entrepreneurs achieve differentiation by locating in organizational niches with high levels of nonoverlap density. In contrast, by actively avoiding direct competition, for-profit entrepreneurs achieve differentiation by locating in organizational niches with low levels of overlap density. Notably, both differentiation strategies will increase nonoverlap intensity: the nonprofits' approach will raise nonoverlap intensity by increasing the degree of organizational niche nonoverlap; the for-profits' approach will raise it by lowering the degree of organizational niche overlap. The basis for our expectation that nonoverlap intensity will exert a stronger influence on nonprofit foundings is that nonprofits' competitive orientation will lead them to be more inclined than for-profits to seek facilitative or cooperative relations with potential competitors and be more willing to refrain from vigorous competition with other organizations in partially overlapped organizational niches.

Second, since nonprofits attend to the cultural aspects of their environment and the networks of consensus and meaning that affirm or endorse their activities, and since the availability of social support and resources from the institutional environment surrounding them tends to influence their decisions, we expect relational density to have a larger effect on founding in the nonprofit sector. This point is reinforced by the tendency for society to view links to legitimated public and community institutions as compatible with normative expectations when they are established with nonprofit organizations and to question the social validity of these same links when they are established with for-profit organizations. Thus, when external endorsements from reputable institutional constituents augment the intrinsic social legitimacy of nonprofits, these relational effects will have a more significant impact on the nonprofit founding rate than on the for-profit founding rate. Therefore, we predict the following same-sector effects—effects within the nonprofit sector and within the for-profit sector.

> *Hypothesis 1b: Same-sector overlap density has stronger effects on the founding rate in the for-profit sector of an organizational population than it has on the founding rate in the nonprofit sector.*

> *Hypothesis 2b: Same-sector nonoverlap density has stronger effects on the founding rate in the nonprofit sector of an organizational population than it has on the founding rate in the for-profit sector.*
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> *Hypothesis 3b: Same-sector nonoverlap intensity has stronger effects on the founding rate in the nonprofit sector of an organizational population than it has on the founding rate in the for-profit sector.*
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> *Hypothesis 4b: Same-sector relational density has stronger effects on the founding rate in the nonprofit sector of an organizational population than it has on the founding rate in the for-profit sector.*

Cross-sector interaction hypotheses. The above depiction of differences between nonprofit and for-profit sectors implies other important differences, in the between-sector interactions of ecological and institutional processes. First, although the competitive orientation of nonprofits implies weaker same-sector overlap density effects (Hypothesis 1b), the social fitness of nonprofits may lead potential for-profit founders to view nonprofit status as a distinctive competitive advantage in the acquisition of resources and community support and to consider overlap density with the nonprofit sector, therefore, as a formidable deterrent to entry. In contrast, consumers who want an alternative to for-profit services may be stimulated by the prevalence of for-profits to create their own nonprofit organizations (DiMaggio & Anheier, 1990). Second, the less competitive orientation of nonprofits also implies that nonoverlap density and nonoverlap intensity with the nonprofit sector will have stronger facilitative effects on for-profit founding. Potential for-profit founders may exploit nonprofits' inclination toward noncompetition, voluntary cooperation, "co-prosperity", and sharing resources with potential competitors. Finally, for-profits may benefit from residing within the same population as more institutionally acceptable nonprofits. We refer to such benefits as institutional free-rider effects, or advantages derived from inhabiting an institutionally endorsed population (Baum & Oliver, 1992). Therefore, we predict that nonprofit relational density will have stronger effects on for-profit founding. Thus, our overall expectation is that ecological and institutional processes in the nonprofit sector will influence organizational foundings in the for-profit sector more than these same processes in the for-profit sector will influence nonprofit foundings. Specifically, we suggest

> *Hypothesis 1c: Other-sector overlap density has stronger effects on the founding rate in the for-profit sector of an organizational population than on the founding rate in the nonprofit sector.*
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> *Hypothesis 2c: Other-sector nonoverlap density has stronger effects on the founding rate in the for-profit sector of*

an organizational population than on the founding rate in the nonprofit sector.

Hypothesis 3c: Other-sector nonoverlap intensity has stronger effects on the founding rate in the for-profit sector of an organizational population than on the founding rate in the nonprofit sector.

Hypothesis 4c: Other-sector relational density has stronger effects on the founding rate in the for-profit sector of an organizational population than it has on the founding rate in the nonprofit sector.

Levels of Analysis: Spatial Boundaries of Ecological and Institutional Processes

Researchers have begun to explore the level of analysis (spatial aggregation) at which ecological and institutional processes operate in organizational populations. For example, Carroll and Hannan (1992) and Swaminathan and Wiedenmayer (1991) analyzed density dependence in the founding rates of American and German breweries at a variety of levels of spatial aggregation (e.g., city, state, region, nation). In these studies, they estimated the density-dependent legitimation-competition model separately for each level of analysis and then compared coefficients across levels. Results revealed that local and diffuse competitive effects differed much more than comparable legitimation effects in the American brewing industry. Lomi (1995) obtained parallel findings in an analysis of the founding rates of Italian rural cooperative banks. Hannan, Carroll, Dundon, and Torres (1995) estimated models of organizational founding in the European automobile industry in which density-dependent legitimation and competition were measured at different levels of analysis. They found stronger density-dependent legitimation at the European level of analysis and stronger density-dependent competition at the country level.

Taken together, these studies, along with other research (Baum & Mezias, 1992; Baum & Singh, 1994a, 1994b, 1996; Rao & Neilsen, 1992), support Zucker's view that "smaller geographical areas should theoretically involve more intense competition since they are more tightly bounded resource areas" (1989: 543). These studies also support the idea that institutional processes operate at a broad level (Hannan et al., 1995; Singh, 1993), serving to contextualize ecological processes (Scott, 1987; Tucker, Baum, & Singh, 1992). Thus, competitive population processes are often heterogenous, operating most strongly in local environmental arenas, and institutional population processes are often homogeneous, revealing themselves most strongly at higher levels of geographic aggregation. However, we believe it is unlikely that these specifications will be universal. Our view is that the appropriate level of analysis for ecological processes depends on the spatial structure of a population's environment: the more geographically segmented the environment, the more geographically localized competition will tend to be. For institutional processes, we suggest that the appropriate level of analysis depends on the type of process—although cognitive legitimation of organizational populations may commonly unfold in broad spatial contexts, as Hannan and colleagues (1995) asserted, the influence of institutional embeddedness on a population's sociopolitical legitimacy can occur simultaneously at multiple levels, varying with the jurisdiction of the social actors providing institutional support (Aldrich & Fiol, 1994; Baum & Powell, 1995; Scott, 1995).

Spatial boundaries of ecological processes. Competition is more intense at a local level when resource environments are segmented geographically (Carroll & Huo, 1986). In a homogeneous environment, organizations compete for a common, spatially undifferentiated pool of resources, and each organization's competitive effect is potentially felt throughout the population. However, in a spatially heterogeneous environment, each organization's competitive effect is localized to its geographic segment of operations. Thus, even as populations evolve to a state, national, or international level, organizations may remain local in orientation and depend heavily on their immediate environments. Geographic segmentation of organizational environments occurs for a variety of reasons. Institutional and political constraints may limit the geographic scope of organizational activities, leading to distinct segments in which organizations can compete for resources (Amburgey, Dacin, & Kelly, 1994; Hannan et al., 1995). The nature of a population's activities also affects where potential clients or customers come from when, for example, organizations provide services on their premises (as do banks, S&Ls, and child care centers); when transportation costs are high (automobile manufacturers, brewers); when products are made for specific locales (newspapers); or when the demand for organizations' products and services depends on location (hotels). Indeed, in recent studies, the level of analysis at which competition is most intense appears to vary directly with the degree of segmentation. For example, among Manhattan hotels (Baum & Mezias, 1992), competition is most intense within a few city blocks segmented by proximity to business and tourist activities; among European automobile producers (Hannan et al., 1995), competition is most intense within countries segmented by political boundaries.

Just as environmental segmentation creates more tightly bounded competitive arenas, it also creates local interorganizational communities within which the benefits of differentiation and cooperation may be more pronounced. When environments are geographically segmented, the effects of differentiation, like those of competition, will be localized. Segmented environments will also tend to localize the impact of cooperative activities. For example, the geographic segmentation of child care demand means that the potential for cooperation (through referrals, for instance) and complementary demand enhancement (for instance, demand for infant care raising demand for toddler care) to produce beneficial effects is greatest among neighboring day care centers. Neighboring organizations are also more likely to be aware of each other than less proximate organizations, and cooperative behavior is logistically simpler at the local level.

The day care center population's environment is geographically segmented because the locations of centers influence where potential clients or customers come from. Since day care centers provide services on their premises, parents must transport their children to and from them each day. This creates highly localized patterns of demand. As a result, location is a strong influence on the potential for both client-based competition with other DCCs providing services in overlapping organizational niches and noncompetitive and cooperative interaction with other DCCs providing services in nonoverlapping or partially overlapping organizational niches. For this reason, we expected ecological processes to operate most strongly in local geographic arenas in the day care center population. Therefore,

> *Hypothesis 1d: Overlap density has stronger effects on the founding rate in an organizational population at a local level than at a diffuse level.*
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> *Hypothesis 2d: Nonoverlap density has stronger effects on the founding rate in an organizational population at a local level than at a diffuse level.*
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> *Hypothesis 3d: Nonoverlap intensity has stronger effects on the founding rate in an organizational population at a local level than at a diffuse level.*

Spatial boundaries of institutional processes. Institutional theorists highlight two factors that contribute to the legitimacy of organizational populations. Zucker (1977) treated institutionalization as a process, emphasizing that legitimacy is a cognitive phenomenon reflected in taken-for-granted assumptions. Meyer and Rowan (1977) and DiMaggio and Powell (1983) stressed that legitimacy is embedded in relational networks and normative codes of conduct. Thus, they viewed institutionalization as both a sociopolitical process through which certain organizational forms come to be regarded as obligatory, and a state in which organizational forms are buttressed by legal mandate or by widely shared cultural, professional, and political norms and values. Density-dependence theory focuses on cognitive legitimacy: an organizational form is legitimate "when there is little question in the minds of actors that it serves as the natural way to effect some kind of collective action" (Hannan & Carroll, 1992: 34). Hannan and colleagues (1995) concluded that cognitive legitimation operates at a high level of analysis because cultural images flow more freely across social system boundaries than do material resources.

In contrast, sociopolitical effects may operate simultaneously at multiple levels of analysis, depending on the number and jurisdictions of social actors providing institutional support (Baum & Powell, 1995: 530, n. 2). This is because endorsements of organizations and populations by key stakeholders, opinion leaders, or government agencies operate at different levels and have their strongest effects in the home jurisdictions of those actors (Scott, 1995: 60–61). Thus, for institutional actors, "level may be usefully operationalized as the range of jurisdiction" (Scott, 1995: 55). At the same time, such endorsements may have implications beyond institutional actors' home jurisdictions, as they do, for example, when organizations in one jurisdiction use endorsements of similar organizations by actors in other jurisdictions to support claims for their own activities. Such positive externalities seem most likely to arise when endorsing institutions are comparable across jurisdictions (as are schools, for instance) or are local agents of broader institutions (e.g., churches).

Thus, although the spatial boundaries of ecological processes are rooted in the geographic segmentation of environmental resources, the spatial boundaries of institutional embeddedness are rooted in the geographic distribution and jurisdictions of institutional actors. In this study, we distinguished between local community organizations (churches, community centers, and schools) and a municipal government agency with a metropolitan jurisdiction. Our expectation was that the effects of relational density measured as links to community organizations would be contained within local community areas but that the effects of relational density measured as links with the government agency would unfold over the metropolitan region. Following these arguments,

> *Hypothesis 4d: Relational density affects the founding rate in an organizational population most strongly at the level of analysis corresponding to an institution's jurisdiction.*

METHODS

Data Description

We examined the effects of overlap density, nonoverlap density, nonoverlap intensity, and relational density on the founding rate of day care centers (DCCs) in Metropolitan Toronto from January 1971 through December 1989. During these 18 years, the number of DCCs and the number of relationships between them and their institutional environment both increased dramatically. Members of the population also competed intensely for resources and legitimacy, and their services had to be seen as socially acceptable in order for them to attract and retain clients. Therefore, the configuration of the population and its environment suggested that institutional and competitive processes would both have important influences on founding rates.

We compiled life histories on all licensed DCCs existing in Metropolitan Toronto during the 1971–89 period from two sources. The Community Information Center of Metropolitan Toronto's *Directory of Day Cares and Nursery Schools in Metropolitan Toronto,* published since 1971, provided detailed annual information. The Ministry of Community and Social Services' *Day Nurseries Information System,* which, starting in 1979, contains licensing records for all DCCs operating in Ontario, provided additional information and a cross reference to the *Directory*. During the study period, 682 DCCs were founded—460 nonprofit and 222 for-profit. We defined date of founding as the year in which the Ministry issued the original operating license or the year of first appearance in the *Directory*. At the start of 1971, 109 DCCs existed in Metropolitan Toronto. Although we knew their dates of founding, we lacked detailed information on the population's history before 1971. Consequently, we could not include information on the foundings of the DCCs existing in Metropolitan Toronto at the start of 1971. However, we included these DCCs when computing the overlap, nonoverlap, and relational density measures that are of central interest in this study.

Carroll and Hannan (1989) have criticized studies of population dynamics that fail to incorporate data on the early years of a population's history. Therefore, we were concerned with the extent to which our data censored the early history of DCCs. As is discussed in detail elsewhere (Baum & Oliver, 1992; Baum & Singh, 1994b), our data cover the most significant period in the history of DCCs in Metropolitan Toronto, including the first major period of growth and the period during which day care centers acquired legitimacy as providers of a service needed by families at all income levels (Metropolitan Toronto Day Care Planning Task Force, 1986). Consequently, we think the 1971–89 observation period minimizes the risks associated with a lack of data on the population's early history. Supporting our belief, past studies support curvilinear effects of population density on founding and failure rates in this population (Baum & Oliver, 1992; Baum & Singh, 1994a, 1994b).

Independent Variables

Overlap density, nonoverlap density, and nonoverlap intensity. We defined the organizational niches of DCCs using two key dimensions. The first is a critical resource dimension, the ages of the children centers are licensed to enroll. A day care center operating in Metropolitan Toronto is required to obtain an annual operating license from the Ontario Ministry of Community and Social Services. DCCs are licensed to provide full-time (more than six hours a day) care to five or more children in one or more of the following age ranges: infant, birth–18 months; toddler, 19–30 months; preschool, 31–60 months; and school-age, 61–120 months. They are free to become licensed in one or more age ranges but must meet specified criteria, which include staff, program, equipment, and facility requirements geared to the developmental needs of children in a given age range. The second dimension is profit orientation. As we described above, profit orientation can profoundly influence how DCCs and their founders respond to the environment. Moreover, in the child care sector, profit orientation is a critical distinction because influential social actors and the Canadian public increasingly view for-profit child care as illegitimate and incompatible with institutionalized definitions of appropriate and acceptable day care provision.

In this study, we used DCCs' license specifications and profit status to describe their organizational niches. Table 1 shows the locations and widths (the range of the ages of children, in months, that can be enrolled by DCCs in an organizational niche) of the organizational niches occupied by nonprofit and for-profit day care centers. Table 1 also gives the matrix of overlaps among the organizational niches (the portion of the client resource space, in months, that DCCs in different organizational niches occupy jointly).[2] Table 2 gives the organizational niche overlap weights (w_{ij}) between all pairs of organizational niches based on the overlaps in Table 1. Table 3 gives the organizational niche nonoverlap/overlap ratios (k_{ij}) between all pairs of organizational niches; these are also based on the overlaps in Table 1. Figures 1 and 2 present the number of DCCs in each organizational niche, by profit orientation, at the start of each year. Figure 3 gives the total number of nonprofit and for-profit DCCs.

We computed yearly values for overlap density for each organizational niche (by profit orientation) using Equation 1 and the organizational niche overlap weights (w_{ij}) from Table 2. For example, overlap density for the nonprofit infant-toddler organizational niche in 1981 is

$$(.6 \times 0_{I}) + (.4 \times 0_{T}) + (0 \times 61_{P}) + (0 \times 63_{S}) + (1 \times 6_{IT}) + (.4 \times 1_{TP}) + (0 \times 58_{PS}) + (1 \times 3_{ITP}) + (.4 \times 9_{TPS}) + (1 \times 4_{ITPS}) = 17,$$

where $N_{I} \ldots N_{ITPS}$ are the nonprofit sector organizational niches' densities in 1981. The value for nonoverlap density is equal to the number of nonprofit DCCs in 1981 minus overlap density (205 − 17 = 188).

We computed yearly values for nonoverlap intensity for each organizational niche (by profit orientation) using Equation 3 and the organizational niche nonoverlap/overlap ratios (k_{ij}) from Table 3. For example, nonoverlap intensity for the nonprofit infant-toddler organizational niche in 1981 is

$$(0 \times 0_{I}) + (0 \times 0_{T}) + (0 \times 6_{IT}) + (4 \times 1_{TP}) + (.625 \times 3_{ITP}) + (9 \times 9_{TPS}) + (3 \times 4_{ITPS}) = 98.875$$

where, again, $N_{I} \ldots N_{ITPS}$ are the nonprofit sector organizational niches' densities in 1981.

To compare the strengths of localized ecological processes operating among neighboring DCCs and more diffuse ecological processes operating among more distant DCCs, we calculated separate local and diffuse measures for each ecological variable based on the geographic proximity of DCCs within Metropolitan Toronto. Local measures were computed using information on the DCCs operating in each of the six cities constituting Metro-

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[2] The widths (in months) of the licensed age ranges are used to compute the overlaps in Table 1 since, on the average, over the observation period the numbers of children of each age are roughly equal. Thus, the distribution of resources across the age ranges is approximately equal to the widths of the age ranges.

TABLE 1
DCC Organizational Niche Widths and Overlaps[a,b]

	Organizational Niche *i*									
Organizational Niche *j*	**I**	**T**	**P**	**S**	**IT**	**TP**	**PS**	**ITP**	**TSP**	**ITPS**
Infant (I)	18									
Toddler (T)	0	12								
Preschool (P)	0	0	30							
School-age (S)	0	0	0	60						
Infant/toddler (IT)	18	12	0	0	30					
Toddler/preschool (TP)	0	12	30	0	12	42				
Preschool/school-age (PS)	0	0	30	60	0	30	90			
Infant/toddler/preschool (ITP)	18	12	30	0	30	42	30	60		
Toddler/preschool/school-age (TPS)	0	12	30	60	12	42	90	42	102	
Infant/toddler/preschool/school-age (ITPS)	18	12	30	60	30	42	90	60	102	120

[a] The width (in months) of each age range is given on the diagonal; the overlaps (in months) between age ranges are reported below the diagonal; only observed configurations of licensed age ranges are included.

[b] I = infant, 0–18 months; T = toddler, 19–30 months; P = preschool, 31–60 months; S = school-age, 61–120 months; IT = 0–30 months; TP = 19–60 months; PS = 31–120 months; ITP = 0–60 months; TPS = 19–120 months; and ITPS = 0–120 months.

TABLE 2
DCC Organizational Niche Overlap Weights[a]

	Organizational Niche *i*									
Organizational Niche *j*	I	T	P	S	IT	TP	PS	ITP	TPS	ITPS
Infant (I)	1	0	0	0	.600	0	0	.300	0	.150
Toddler (T)	0	1	0	0	.400	.285	0	.200	.117	.100
Preschool (P)	0	0	1	0	0	.714	.333	.500	.294	.250
School-age (S)	0	0	0	1	0	0	.667	0	.588	.500
Infant/toddler (IT)	1	1	0	0	1	.285	0	.500	.117	.250
Toddler/preschool (TP)	0	1	1	0	.400	1	.333	.700	.411	.350
Preschool/school-age (PS)	0	0	1	1	0	.714	1	.500	.882	.750
Infant/toddler/preschool (ITP)	1	1	1	0	1	1	.333	1	.411	.500
Toddler/preschool/school-age (TPS)	0	1	1	1	.400	1	1	.700	1	.850
Infant/toddler/preschool/school-age (ITPS)	1	1	1	1	1	1	1	1	1	1

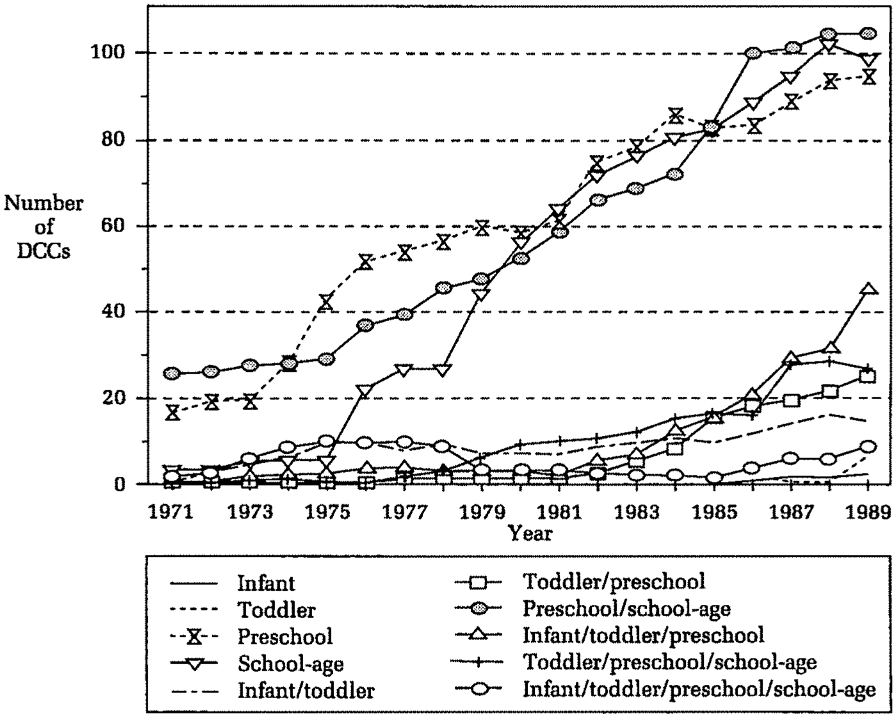
[a] The organizational niche overlap weights (w_{ij}) are ratios of the overlaps between organizational niches *i* and *j* over the width of *i*. The competitive effect of DCCs in organizational niche *j* on those in *i* are reported in column *i*. For example, from Table 1, w_{ij} of IT on TP is .285, which is computed by dividing their niches' overlap (T = 12) by the width of TP (42).

TABLE 3
DCC Organizational Niche Nonoverlap/Overlap Ratios[a]

	Organizational Niche *i*									
Organizational Niche *j*	**I**	**T**	**P**	**S**	**IT**	**TP**	**PS**	**ITP**	**TPS**	**ITPS**
Infant (I)	0				0			0		0
Toddler (T)		0			0	0		0	0	0
Preschool (P)			0			0	0	0	0	0
School-age (S)				0			0		0	0
Infant/toddler (IT)	.667	1.500			0	4.000		0	9.000	0
Toddler/preschool (TP)		2.500	.400		4.000	0	2.400	0	0	0
Preschool/school-age (PS)			2.000	.500		2.400	0	3.000	0	0
Infant/toddler/preschool (ITP)	2.333	4.000	1.000		.625	.429	2.600	0	1.857	0
Toddler/preschool/school-age (TPS)		7.500	2.400	.700	9.000	1.429	.133	1.857	0	0
Infant/toddler/preschool/school-age (ITPS)	5.667	9.000	3.000	1.000	3.000	1.857	.333	1.000	.176	0

[a] The organizational niche nonoverlap/overlap ratios (k_{ij}) are ratios of the organizational niche overlaps to nonoverlaps between organizational niches *i* and *j*. For example, from Table 1, k_{ij} of TP with IT is 4.000, which is computed by dividing the niches' nonoverlap (I + P = 18 + 30 = 48) by their overlap (T = 12). Blank organizational niches have $w_{ij} = 0$ and are not used in computing *nonoverlap intensity*$_{ij}$.

FIGURE 1
Nonprofit DCCs—Organizational Niche Densities



politan Toronto. Diffuse measures were computed for each city using information on DCCs operating in all the other cities.[3]

Government and community relational densities. Relational density is the number of links between the DCC population and key government and community organizations in the environment. We used two separate measures of relational density to reflect the extent of (1) municipal government and (2) local community involvement in the activities of DCCs: the number of purchase-of-service agreements, which we call *POSA density,* and the number of site-sharing arrangements, which we call *SSA density.* Both nonprofit and for-profit DCCs are free to establish or forego either of these relations.

A *purchase-of-service agreement* (POSA) establishes a direct relationship between a day care center and the Children's Services Division of Metropolitan Toronto. This division has a metropolitan jurisdiction and is a very

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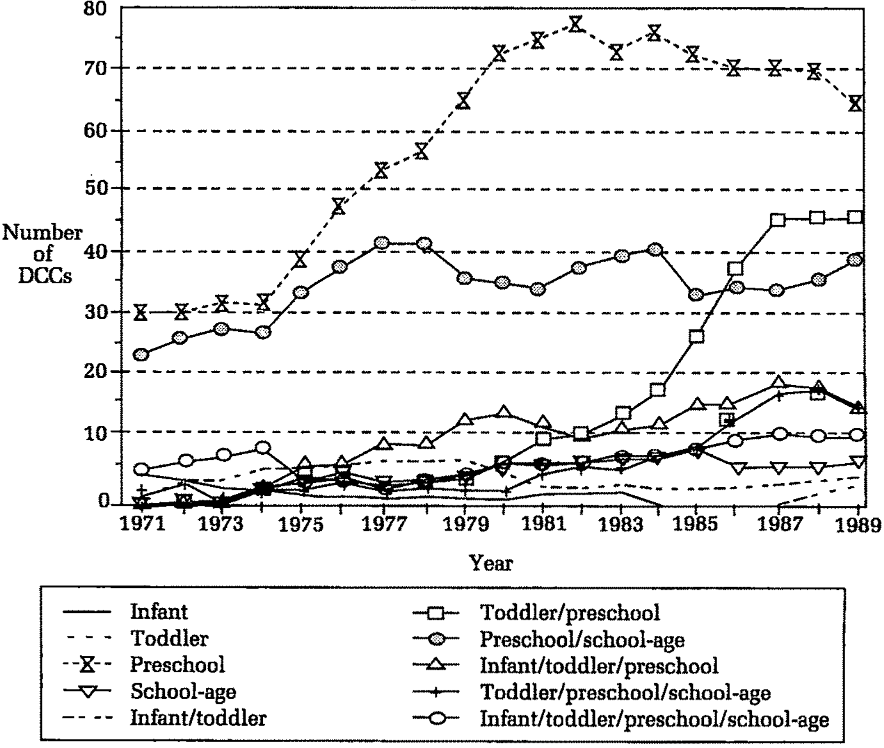
[3] The cities that compose Metropolitan Toronto are East York, Etobicoke, North York, Scarborough, Toronto, and York. Our approach follows other studies that compute local and diffuse measures using geographic boundaries of cities, counties, and states (Barnett & Carroll, 1987; Carroll & Wade, 1991; Swaminathan & Wiedenmayer, 1991).

FIGURE 2
For-Profit DCCs—Organizational Niche Densities



important government constituent in the population's environment. Through POSA links, the Children's Service Division provides subsidized care for the children of residents of the metropolitan area who qualify for financial assistance. When a DCC is granted a purchase-of-service agreement, parents receiving assistance can purchase its services. Although POSAs provide access to clients whose fees are subsidized, they do not guarantee resource flows. Centers that obtain POSAs are legally restricted from charging subsidized clients more than their regular fees and may be required to accept a lower fee, and DCCs must compete among themselves for subsidized clients.[4] POSAs also enhance a day care center's legitimacy. Because the Children's Service Division imposes high quality standards through unannounced, full-day, on-site inspections made up to three times per year, a purchase-of-service agreement is a strong endorsement of a DCC's operations. Such endorsements are an important reassurance to parents, and

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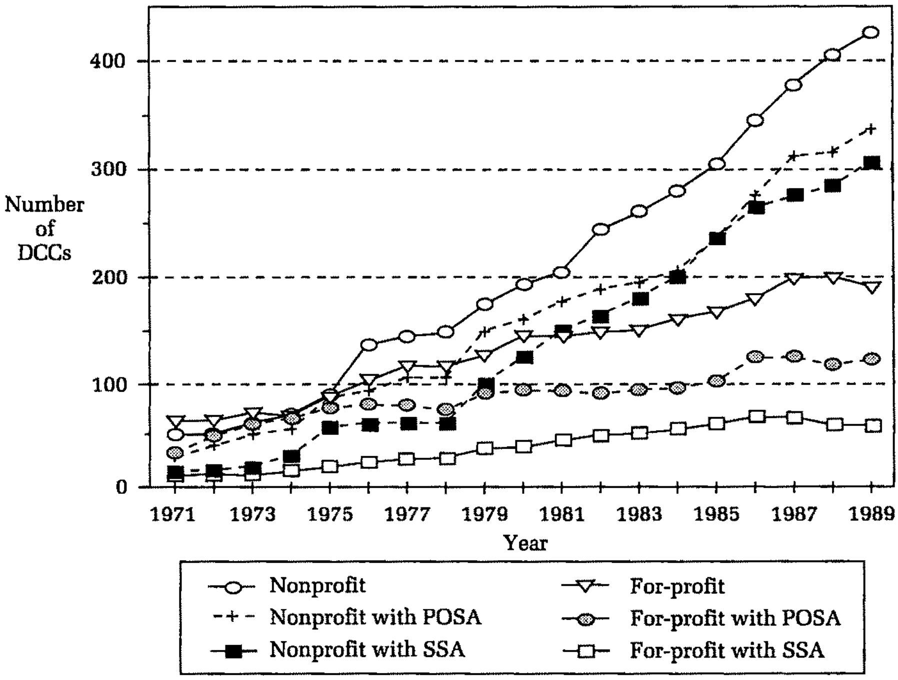
[4] In all models we controlled for the constant dollar value of the Children's Service Division's annual budget, which captures the total value of government resources flowing through these links to DCCs. Doing this helped confirm that the effects of POSA density on founding rates were not exclusively the result of economic factors.

FIGURE 3
Nonprofit and For-Profit DCCs—Sectoral and Relational Densities



centers often publicize these agreements (Baum & Oliver, 1991). The cultural framework surrounding child care exerts significant pressures on day care center operators to incorporate and exhibit ideal systems of quality care. Institutional expectations tend to be diffuse; POSAs help to concretize institutional expectations about ideal child care.

DCCs may operate on their own independent premises or in space leased from or provided by other local community-based organizations, including community centers, schools, and churches. A *site-sharing arrangement* (SSA) permits a day care center to operate within the physical facilities of another legitimated community organization. Such arrangements can reduce a center's overhead costs and can also provide access to the local client pool associated with the host organization. Site sharing with a respected community organization also enhances the center's legitimacy within the local client population. DCCs that operate in churches, public schools, and other respected community agencies are perceived to be more legitimate community participants than those that do not. Because child care quality is difficult to judge, parents must rely on more general indicators. Schools, churches, and reputable community centers represent and embody the broader normative conceptions and cultural expectations of caring, humane service in the provision of child care. Like purchase-of-service agreements, site-sharing arrangements reflect diffuse cultural conceptions and implicit theories of the role and importance of reliable child care service.

Relational density was defined as the number of relations between day care centers and government institutions (POSA density) and community institutions (SSA density) at the start of each year as reported in either the Day Nurseries Information System or the Community Information Center's *Directory*. To test for hypothesized within- and cross-sector differences in institutional embeddedness, we computed POSA and SSA densities separately for nonprofit and for-profit DCCs. To test for the predicted inverted U-shaped effects, we modeled relational density measures as quadratics by including both relational density and relational density squared, with the squared terms divided by 1,000 for rescaling. Again, we used information on DCCs' geographical locations to compute diffuse and local POSA and SSA density measures to distinguish between metropolitan-area-wide government-based institutional processes and more localized community-based processes operating at lower levels of spatial aggregation. Figure 3 shows the number of nonprofit and for-profit DCCs with POSAs and SSAs at the start of each year.

Control Variables

To rule out plausible alternative explanations, we controlled for several measures of the environmental carrying capacity. First, we estimated the demand in age range i in location j on a yearly basis as

$$Demand_{ij} = EN_{ij} + \%WW(NC_{ij} - EN_{ij}) + \%SP[(NC_{ij} - EN_{ij})(1 - \%WW)], \quad (4)$$

where $demand_{ij}$ is the estimated annual demand for day care center services in age range i in location j, EN_{ij} is the number of children in age range i in location j who are enrolled in a DCC, $\%WW$ is the percentage of women residing in Metropolitan Toronto who participate in the workforce full-time, NC_{ij} is the total number of children in age range i in location j, and $\%SP$ is the percentage of children from 0 to 10 years of age in Metropolitan Toronto who live in single-parent families.[5] As in other child care studies (Maynard, 1985; Rose-Ackerman, 1988), the demand equation weights the number of children (of particular ages and in particular locations) by factors (for instance, the percentages of working women and children in single-parent families) related to the likelihood that they will require day care services. We estimated the third component after factoring out unenrolled children of working mothers, since the majority of single parents in Metropolitan Toronto are working women (City of Toronto Planning and Development De-

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[5] Longitudinal data on working women and single parents were unavailable for each city, but census data (Social Planning Council of Metropolitan Toronto, 1981) indicated that variation among cities was small. In 1981, the percentage of single-parent families with children aged 0–5 years ranged from 9.8 percent (East York) to 13.1 percent (Toronto). The percentage of women active in the workforce full-time ranged from 58.1 percent (York) to 61.5 percent (Scarborough).

partment, 1983; Social Planning Council of Metropolitan Toronto, 1981). Annual measures of local and diffuse organizational niche demand were constructed from estimates for each age range in each location. We generally expected positive relationships between demand and the founding rate. However, the geographic segmentation of child care demand implies a stronger relationship at the local level.

The second environmental control variable was the value of the Children's Service Division budget in constant dollars, a measure of the level of government resources provided to needy parents for purchasing services from day care centers with POSAs. The number of graduates of early childhood education programs at Ontario community colleges was the next environmental control variable. These graduates represent the pool of new labor that meets government-mandated staff qualification requirements. The fourth control variable was the interest rate for small business loans. Although DCCs are small organizations, their rate of founding may still be sensitive to increases in interest rates on term loans made to cover start-up costs. Lastly, in order to control for variations in the founding rate across organizational niches and constituent cities, we created two sets of dummy variables. In the analysis, the dummy variables for the school-age organizational niche and the City of Etobicoke were excluded as comparison groups.

Dependent Variables and Analysis: Poisson and Negative Binomial Regression

The present study analyzes the pooled cross-sectional time series data on day-care-center foundings in an analysis-of-variance/panel-data-analysis statistical framework (Hauseman, Hall, & Griliches, 1984). Drawing on archival information, we classified all DCC foundings by organizational niche and geographic location. The dependent variables are the yearly numbers of nonprofit and for-profit DCC foundings that occurred in each organizational niche in each of Metropolitan Toronto's six constituent cities.

Because our dependent variables are count measures, we estimated the number of organizational foundings expected to occur within an interval of time. A Poisson process provides a natural baseline model for organizational founding processes (Barnett & Amburgey, 1990; Hannan & Freeman, 1989; Lomi, 1995; Ranger-Moore, Banasak-Hall, & Hannan, 1991) that is appropriate for relatively rare events (Coleman, 1981). The basic Poisson model for event count data is $\Pr(Y_t = y) = e^{\lambda(x_t)}[\lambda(x_t)^y/y!]$, where both the expected number of events in a unit interval, $\Pr(Y_t = y)$, and the variance of the number of events in each interval equal the rate $\lambda(x_t)$. Thus, the basic Poisson model implies that there is no heterogeneity in the sample. However, for count data on organizational founding, the variance may often exceed the mean (Ranger-Moore et al., 1991). Overdispersion causes the standard errors of parameters to be underestimated and the statistical significance of coefficients to be overstated. To correct for overdispersion, we used the negative binomial regression model. A common formulation is $\lambda_t = \exp(\pi' x_t)\epsilon_t$, where the error term, ϵ_t, follows a gamma distribution. The presence of ϵ_t produces overdispersion. The specification of overdispersion we used takes the form $Var(Y_t) = E(Y_t)[1 + \alpha E(Y_t)]$. We estimated this model using LIMDEP 6.0 (Greene, 1992). In a preliminary analysis, negative binomial models generally improved the fit significantly over Poisson models, indicating a substantial degree of overdispersion. Therefore, we report estimates from negative binomial regression models.

RESULTS

Table 4 reports negative binomial regression estimates for the analysis of nonprofit and for-profit DCC founding rates at the local-organizational-niche level of analysis. Estimates for the organizational niche and geographic location control variables appear in Table 5.[6] Models 1 and 5 in Table 4 provide baseline models of local and diffuse ecological effects on the day care center founding rate for nonprofit and for-profit sectors, respectively. Models 2 and 6 add quadratic specifications for diffuse and local same-sector POSA and SSA densities. Several quadratic relational density specifications are not significant. Therefore, we recomputed the models after removing all insignificant squared terms; doing so did not reduce the fit of the models (model 2 vs. 3 = 2.93, 2 *df*, n.s.; model 6 vs. 7 = .78, 3 *df*, n.s.).[7] Thus, the second-order effects in models 2 and 6 do not improve over monotonic specifications of these variables in models 3 and 7. Models 3 and 7 also improve on the fit of the baseline ecological models significantly (model 1 vs. 3 = 38.37, 6 *df*, $p < .05$; model 5 vs. 7 = 14.2, 5 *df*, $p < .05$). Finally, we introduce the other-sector variables in models 4 and 8, which both improve over the same-sector effects models (model 3 vs. 4 = 42.29, 10 *df*, $p < .05$; model 7 vs. 8 = 62.17, 10 *df*, $p < .05$). Hence, we interpret models 4 and 8.[8]

The overall pattern of coefficients in models 4 and 8 lends broad support to our global ecological predictions, Hypotheses 1a–3a. All significant coefficients for same- and other-sector overlap density are negative in direction, and all significant coefficients for same- and other-sector nonoverlap density and nonoverlap intensity are positive in direction. Most coefficients for the diffuse measures are insignificant, however. Support for our global institutional prediction, Hypothesis 4a, is more equivocal, with coefficients conforming to the predicted inverted-U pattern for same-sector POSA density at the diffuse level of analysis in the nonprofit sector and the local level of analysis in the for-profit sector, and for same-sector SSA density only at the

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[6] A comparable analysis at the Metropolitan Toronto level, available from the authors, yields broadly similar findings.

[7] We report a likelihood ratio in Table 4 to compare the goodness-of-fit of nested models. If the null hypothesis is true, the difference between the likelihood ratios has a chi-square distribution with degrees of freedom equal to the number of constraints that have been freed. For example, a likelihood-ratio test between models 1 and 2 compares the values 641.68 and 600.38. The difference of 41.3 with 8 degrees of freedom is significant at $p < .05$.

[8] Including quadratic other-sector relational density specifications did not significantly improve the fit of either model 4 (2.77, 4 *df*, n.s.) or model 8 (3.28, 4 *df*, n.s.).

TABLE 4
Negative Binomial Models of DCC Founding, Local-Organizational-Niche Level of Analysis[a]

	Nonprofit Models				For-Profit Models			
Variables	1	2	3	4	5	6	7	8
Constant	0.502	2.776*	3.121*	−2.875*	0.383	−0.414	−1.424	−3.604*
	(0.662)	(0.924)	(0.898)	(1.362)	(1.035)	(2.238)	(1.506)	(1.670)
Bank rate	−0.051*	−0.003	−0.018	−0.043	−0.074*	−0.015	−0.073*	−0.123*
	(0.019)	(0.033)	(0.032)	(0.047)	(0.031)	(0.045)	(0.035)	(0.062)
Children's Service Division budget/100,000	0.006	0.028	0.025	0.031	0.041*	0.047*	0.042*	0.136*
	(0.017)	(0.027)	(0.026)	(0.035)	(0.017)	(0.020)	(0.019)	(0.052)
Early childhood education graduates/100	0.246*	0.810*	0.732*	0.701*	0.769*	0.678*	0.765*	0.709*
	(0.085)	(0.168)	(0.147)	(0.162)	(0.194)	(0.231)	(0.205)	(0.220)
Diffuse demand/1,000	0.148*	0.182*	0.191*	0.130*	0.051	0.071	0.064	0.032
	(0.030)	(0.039)	(0.038)	(0.052)	(0.048)	(0.059)	(0.057)	(0.071)
Local demand/1,000	0.134*	0.184*	0.180*	0.130*	0.133*	0.142*	0.138*	0.146*
	(0.033)	(0.042)	(0.041)	(0.055)	(0.053)	(0.064)	(0.061)	(0.075)
Same-sector								
Diffuse overlap density	−0.002	−0.029*	−0.020	−0.022	−0.026*	−0.062*	−0.067*	−0.078*[b]
	(0.003)	(0.016)	(0.015)	(0.026)	(0.012)	(0.029)	(0.027)	(0.042)
Local overlap density	−0.008*	−0.062*	−0.062*	−0.064*[c]	−0.072*	−0.098*	−0.091*	−0.090*[b,c]
	(0.004)	(0.026)	(0.025)	(0.032)	(0.026)	(0.041)	(0.036)	(0.045)
Diffuse nonoverlap density	0.012*	0.009	0.006	0.008	0.031*	0.002	0.004	0.009
	(0.006)	(0.015)	(0.015)	(0.025)	(0.014)	(0.024)	(0.017)	(0.033)
Local nonoverlap density	0.011*	0.075*	0.065*	0.100*[c]	0.008	0.036	0.042	0.034
	(0.004)	(0.026)	(0.025)	(0.032)	(0.032)	(0.045)	(0.039)	(0.058)
Diffuse nonoverlap intensity	−0.002	−0.001	−0.001	−0.003	−0.004	−0.003	−0.002	−0.001
	(0.002)	(0.002)	(0.002)	(0.003)	(0.005)	(0.005)	(0.004)	(0.005)
Local nonoverlap intensity	0.007*	0.007*	0.008*	0.012*[c]	0.013	0.009	0.011	0.014
	(0.003)	(0.003)	(0.003)	(0.004)	(0.009)	(0.009)	(0.009)	(0.010)

TABLE 4 (continued)

Variables	Nonprofit Models				For-Profit Models			
	1	2	3	4	5	6	7	8
Diffuse POSA density		0.060*	0.043*	0.053*^{b,c}		0.003	0.037	0.039
		(0.025)	(0.012)	(0.017)		(0.063)	(0.028)	(0.037)
Diffuse POSA density squared/1,000		−0.184*	−0.125*	−0.137*		0.288		
		(0.075)	(0.050)	(0.062)		(0.438)		
Local POSA density		−0.051	−0.024*	−0.068*		0.187*	0.240*	0.289*
		(0.041)	(0.014)	(0.019)		(0.108)	(0.089)	(0.100)
Local POSA density squared/1,000		0.107				−3.901*	−5.278*	−6.883*
		(0.253)				(2.308)	(1.750)	(1.921)
Diffuse SSA density		−0.016	0.029*	0.039*^{b}		0.036	0.048	−0.106
		(0.025)	(0.015)	(0.023)		(0.098)	(0.049)	(0.077)
Diffuse SSA density squared/1,000		0.135*				0.007		
		(0.077)				(0.806)		
Local SSA density		0.098*	0.043*	0.121*^{b,c}		0.038	−0.096*	−0.132*
		(0.042)	(0.024)	(0.041)		(0.139)	(0.057)	(0.077)
Local SSA density squared/1,000		−0.212*	−0.167*	−0.236*		−3.476		
		(0.089)	(0.069)	(0.111)		(1.991)		
Other-sector								
Diffuse overlap density				−0.017				−0.100*^{b}
				(0.030)				(0.035)
Local overlap density				−0.095*^{c}				−0.172*^{b,c}
				(0.039)				(0.051)
Diffuse nonoverlap density				−0.019				0.021
				(0.030)				(0.035)
Local nonoverlap density				0.043				0.161*^{b,c}
				(0.038)				(0.052)
Diffuse nonoverlap intensity				−0.004				0.000
				(0.003)				(0.005)

TABLE 4 (continued)

Variables	Nonprofit Models				For-Profit Models			
	1	2	3	4	5	6	7	8
Local nonoverlap intensity				−0.007				0.012*[b,c]
				(0.007)				(0.006)
Diffuse POSA density				0.034*[d]				0.096[b,d]
				(0.018)				(0.027)
Local POSA density				0.024				−0.110*
				(0.028)				(0.040)
Diffuse SSA density				−0.013				0.066
				(0.050)				(0.046)
Local SSA density				−0.102*				0.205*[b,c]
				(0.059)				(0.060)
α[e]	.517*	.461*	.475*	.292*	.390*	.276	.275	.032
	(.130)	(.125)	(.123)	(.114)	(.216)	(.203)	(.198)	(.157)
Likelihood ratio	641.68	600.38	603.31	561.02	422.91	407.93	408.71	346.54
df	27	35	33	43	27	35	32	42

[a] Standard errors are in parentheses. The sample includes 1,080 local organizational-niche years and 460 nonprofit and 222 for-profit foundings. All same- and other-sector density variables are divided by ten for rescaling. In models 1–4, *same-sector* is the nonprofit sector and *other-sector* is the for-profit sector. In models 5–8, *same-sector* is the for-profit sector and *other-sector* is the nonprofit sector.

[b] Coefficient larger than coefficient for same variable in other sector, $p < .05$.

[c] Local coefficient larger than diffuse coefficient for variable in that sector, $p < .05$.

[d] Diffuse coefficient larger than local coefficient for variable in that sector, $p < .05$.

[e] α = the overdispersion parameter.

* $p < .05$

TABLE 5
Organizational Niche and Location Dummy Variables Estimates[a]

Variables	Models							
	1	2	3	4	5	6	7	8
Infant	−4.120*	−4.238*	−4.219*	−4.545*	0.835	0.618	0.536	−0.076
	(0.871)	(0.881)	(0.881)	(0.925)	(1.340)	(1.351)	(1.345)	(1.573)
Toddler	−2.448*	−2.382*	−2.431*	−2.499*	3.002*	2.241	2.207	2.273
	(1.309)	(1.304)	(1.304)	(1.369)	(1.791)	(1.840)	(1.810)	(2.125)
Preschool	0.646*	0.671*	0.636*	1.233*	3.439*	2.958*	2.783*	2.955*
	(0.304)	(0.314)	(0.311)	(0.522)	(0.983)	(1.048)	(1.008)	(1.041)
Infant/toddler	−0.749	−0.698	−0.703	−0.881	2.459*	2.341*	2.253*	2.066*
	(0.498)	(0.500)	(0.503)	(0.558)	(0.839)	(0.865)	(0.856)	(1.032)
Toddler/preschool	−1.801*	−1.788*	−1.806*	−1.347*	2.582*	2.216*	2.084*	2.114*
	(0.350)	(0.350)	(0.349)	(0.464)	(0.823)	(0.863)	(0.834)	(0.879)
Preschool/school-age	−0.572	−0.559	−0.555	−0.289	2.459*	2.372*	2.322*	2.311*
	(0.315)	(0.314)	(0.313)	(0.346)	(0.651)	(0.657)	(0.651)	(0.661)
Infant/toddler/preschool	−1.580*	−1.591*	−1.589*	−1.274*	2.255*	2.023*	1.941*	1.786*
	(0.302)	(0.304)	(0.304)	(0.358)	(0.674)	(0.690)	(0.676)	(0.761)
Toddler/preschool/school-age	−3.162*	−3.143*	−3.136*	−2.871*	0.877	0.776	0.733	0.841
	(0.537)	(0.536)	(0.535)	(0.548)	(0.747)	(0.753)	(0.749)	(0.762)
Infant/toddler/preschool/school-age	−3.375*	−3.389*	−3.362*	−3.090*	0.298	0.320	0.318	0.223
	(0.568)	(0.571)	(0.569)	(0.591)	(0.781)	(0.786)	(0.787)	(0.813)
Toronto	1.287*	1.326*	1.171*	2.080*	0.520	0.397	0.328	1.663
	(0.464)	(0.753)	(0.747)	(1.180)	(0.425)	(0.601)	(0.511)	(1.213)
York	−0.600*	−0.488*	−0.450	−1.535*	−1.119*	−0.016	0.124	0.709
	(0.283)	(0.287)	(0.284)	(0.780)	(0.678)	(1.073)	(0.999)	(1.074)
North York	1.062*	0.506	0.477	1.346*	0.497	0.552	0.607	1.269
	(0.313)	(0.472)	(0.467)	(0.547)	(0.397)	(0.463)	(0.445)	(0.599)
East York	−1.059*	−0.868*	−0.840*	−2.406*	−0.858	0.096	0.291	0.523
	(0.337)	(0.350)	(0.347)	(0.734)	(0.688)	(0.948)	(0.910)	(0.958)
Scarborough	0.593	0.289	0.183	1.811*	0.087	−0.079	0.040	0.282
	(0.243)	(0.282)	(0.278)	(0.555)	(0.352)	(0.612)	(0.563)	(0.603)

[a] Estimates are for Table 4 results. Standard errors are in parentheses. The school-age organizational niche and City of Etobicoke are excluded as comparison groups. The sample included 1,080 local-organizational-niche-years and 682 foundings.

* $p < .05$

local level in the nonprofit sector. Other-sector POSA and SSA densities also have significant effects on day care center founding, but they are exclusively monotonic, failing to support Hypothesis 4a. Below, we examine our fine-grained hypotheses and assess the extent to which the overall pattern of support for our global hypotheses is consistent with them.

Following Miner, Amburgey, and Stearns (1990: 704) and Rao and Neilsen (1992: 464), we tested for predicted differences between the individual regression coefficients for local and nonlocal and nonprofit and for-profit in models 4 and 8 by using the comparison-of-means test (Wonnacott & Wonnacott, 1970: 275). Tables 6, 7, and 8 present the results of our comparison-of-means tests for Hypotheses 1b–4b, 1c–4c, and 1d–4d, respectively.[9]

Nonprofit versus For-Profit, Same Sector

Table 6 shows the results of tests of Hypotheses 1b–4b, our predictions about differences in the sizes of the same-sector effects of our theoretical variables (effects of nonprofit on nonprofit and of for-profit on for-profit). Hypothesis 1b predicts that the competitive effects of same-sector overlap density on founding will be stronger in the for-profit sector. This hypothesis is supported at both local and nonlocal levels. At the local level, both coefficients are significant and negative, but a comparison-of-means test indicates that the coefficient for the for-profit sector is significantly larger. At the nonlocal level of analysis, only the for-profit coefficient is negative and significant, and a comparison-of-means test yields a significant difference. Thus, as we predicted, each for-profit DCC generated significantly more competition in the for-profit sector than each nonprofit DCC does in the nonprofit sector.

Hypothesis 2b predicts that stronger mutualistic effects of same-sector nonoverlap density will flow from the nonprofit sector. This hypothesis is supported only at the local level of analysis; the only significant effect of same-sector nonoverlap density occurs at the local level of analysis in the nonprofit sector. The pattern is the same for the effects of same-sector nonoverlap intensity, which we also predicted (Hypothesis 3b) would have a stronger mutualistic effect in the nonprofit sector. Thus, as we predicted, each nonprofit DCC generates significantly more mutualism in the nonprofit sector than each for-profit DCC does in the for-profit sector. Although support for Hypotheses 2b and 3b is found only at the local level, we view this

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[9] In our approach, the strength of a variable's effect is conceptualized as its slope—the steeper the slope, the stronger the effect. By comparing coefficients, we can examine the relative slopes of effects and test our hypotheses by answering the question, "If two variables (measured in equivalent units) increase by the same amount, which produces the larger increase in the founding rate?" We consider an alternative view, in which the strength of a variable's effect is measured by its magnitude, in the Appendix. We are grateful to an anonymous reviewer for pointing out this alternative conceptualization.

TABLE 6
Results of Comparison-of-Means Tests: Nonprofit versus For-Profit, Same Sector[a]

Variable	Hypothesis and Predicted Direction of Relationship[b]	Nonprofit Sector	For-Profit Sector	Test Statistic[c]	Support?
Same-sector overlap density	1b, <				
Local		–.064 (.032)*	–.090 (.045)*	5.78*	Yes
Diffuse		–.022 (.026)	–.078 (.042)*	18.06*	Yes
Same-sector nonoverlap density	2b, >				
Local		.100 (.032)*	.034 (.058)	15.71*	Yes
Diffuse		.008 (.025)	.009 (.033)		No
Same-sector nonoverlap intensity	3b, >				
Local		.011 (.004)*	.014 (.010)	–1.29	No
Diffuse		–.003 (.003)	–.001 (.005)		No
Same-sector POSA density/POSA density squared	4b, >				
Local		–.068 (.019)*/n.s.	.289 (.100)*/–6.88 (1.921)*		No
Diffuse		.053 (.017)*/–.137 (.062)*	.039 (.037)/n.s.	5.38*	Yes
Same-sector SSA density/SSA density squared	4b, >				
Local		.121 (.041)*/–.236 (.111)*	–.132 (.077)*/n.s.	46.00*	Yes
Diffuse		.039 (.023)*/n.s.	–.106 (.077)/n.s.	27.47*	Partial

[a] Nonprofit coefficients are from model 4 and for-profit coefficients are from model 8. Standard errors are in parentheses.

[b] Predicted direction of relationship is from the nonprofit sector to the for-profit sector.

[c] If both coefficients were insignificant or the coefficient predicted to be larger was not in the predicted direction, comparison-of-means tests were not performed.

* $p < .05$

as evidence of joint support for Hypotheses 2b and 3b and 2d and 3d (which predict stronger effects of local nonoverlap density and intensity).

Hypothesis 4b predicts stronger same-sector relational density effects in the nonprofit sector. We tested this hypothesis with two measures of relational density, POSA density and SSA density. For POSA density, the hypothesis is not supported at the local level of analysis: the local effect fails to conform to the predicted inverted U-shaped effect on founding in the nonprofit sector. But Hypothesis 4b is supported at the nonlocal level: the POSA density and POSA density squared coefficients conform to the predicted inverted-U pattern in the nonprofit sector, and POSA density has no effect on founding in the for-profit sector. By comparison, supporting Hypothesis 4b, SSA density and SSA density squared have the predicted inverted U-shaped effect on nonprofit founding at the local level, and SSA density has a suppressing effect on founding in the for-profit sector.

Finally, there is partial support for Hypothesis 4b at the nonlocal level: SSA density has a significant, positive effect on founding in the nonprofit sector, but no effect on founding in the for-profit sector. Again, although full support for Hypothesis 4b is found only at the nonlocal level for POSA density and at the local level for SSA density, we interpret this pattern as the union of support for Hypotheses 4b and 4d (which predicts stronger diffuse effects for POSA density and stronger local effects for SSA density).

Nonprofit versus For-Profit, Other Sector

Table 7 shows results of the tests for Hypotheses 1c–4c, our predictions about differences in the sizes of other-sector effects for our theoretical variables (effects of nonprofit on for-profit and of for-profit on nonprofit). Hypothesis 1c predicts that the competitive effects of other-sector overlap density will be stronger in the for-profit sector: nonprofits will generate more competition for for-profits than vice versa. This hypothesis is supported at both local and nonlocal levels of analysis. At the local level, both coefficients are significant and negative, but a comparison-of-means test indicates that the coefficient for the nonprofit sector is significantly larger. At the nonlocal level of analysis, only the nonprofit sector coefficient is significant, and a comparison-of-means test indicates that this coefficient is significantly larger. Thus, as we predicted, each nonprofit DCC generates significantly greater competition in the for-profit sector than vice versa.

Hypothesis 2c predicts that stronger mutualistic effects of other-sector nonoverlap density will emanate from the nonprofit sector. This hypothesis is supported only at the local levels of analysis; the only significant effect of other-sector nonoverlap density occurs at the local level of analysis in the nonprofit sector. The pattern is the same for the effects of other-sector nonoverlap intensity, which is also predicted (Hypothesis 3c) to have a stronger mutualistic effect in the nonprofit sector. Thus, as we predicted, each nonprofit DCC generates significantly more mutualism in both the nonprofit (Hypotheses 2b–3b) and for-profit sectors than each for-profit day care center does. Although support for Hypotheses 2c and 3c is again found only at the

TABLE 7
Results of Comparison-of-Means Tests: Nonprofit versus For-Profit, Other Sector[a]

Variable	Hypothesis and Predicted Direction of Relationship[b]	Nonprofit Sector	For-Profit Sector	Test Statistic[c]	Support?
Other-sector overlap density	1c, >				
Local		–.172 (.051)*	–.095 (.039)*	19.74*	Yes
Diffuse		–.100 (.035)*	–.017 (.030)	30.74*	Yes
Other-sector nonoverlap density	2c, >				
Local		.161 (.052)*	.043 (.038)	31.05*	Yes
Diffuse		.021 (.035)	–.019 (.030)		No
Other-sector nonoverlap intensity	3c, >				
Local		.012 (.006)*	–.007 (.007)	28.67*	Yes
Diffuse		.001 (.005)	–.004 (.003)		No
Other-sector POSA density/POSA density squared	4c, >				
Local		–.110 (.040)*/n.s.	.024 (.028)/n.s.		No
Diffuse		.096 (.027)*/n.s.	.034 (.018)*/n.s.	31.00*	Partial
Other-sector SSA density/SSA density squared	4c, >				
Local		.205 (.060)*/n.s.	–.102 (.059)*/n.s.	63.96*	Partial
Diffuse		.066 (.046)/n.s.	–.013 (.050)/n.s.		No

[a] Nonprofit coefficients are from model 8 and for-profit coefficients are from model 4. Standard errors are in parentheses.

[b] Predicted direction of relationship is from the nonprofit sector to the for-profit sector.

[c] If both coefficients were insignificant or the coefficient predicted to be larger was not in the predicted direction, comparison-of-means tests were not performed.

$^* p < .05$

local level of analysis, as above, we view this as evidence of convergent support for Hypotheses 2c–3c and 2d–3d.

Hypothesis 4c predicts stronger other-sector POSA and SSA density effects emanating from the nonprofit sector. Support for this hypothesis is weak. None of the other-sector relational density effects is in the predicted inverted U-shaped pattern. For POSA density, the hypothesis is not supported at the local level of analysis; the linear coefficient for local other-sector POSA density in the for-profit founding model is significant and negative. But Hypothesis 4c is partially supported at the nonlocal level; the linear coefficients for nonlocal other-sector POSA density are significant and positive in both the nonprofit and for-profit models, but a comparison-of-means test indicates that the nonprofit coefficient is significantly larger. The results for other-sector SSA density also provide partial support for Hypothesis 4c—the linear coefficient for local other-sector SSA density is significant and positive in the nonprofit model, but significant and negative in the for-profit sector. However, the nonlocal other-sector SSA density effects are not significant. Again, the predominance of support at the nonlocal level for POSA density and at the local level for SSA density is consistent with the union of Hypotheses 4c and 4d.

Local versus Nonlocal, Same and Other Sectors

Table 8 shows the results of the tests for Hypotheses 1d–4d, our predictions about differences in the sizes of the local and nonlocal effects of our theoretical variables. Hypothesis 1d predicts that the competitive effects of local overlap density on founding will be stronger than the effects of nonlocal overlap density. Comparison-of-means tests provide support for this hypothesis in both the nonprofit and for-profit sectors and for same-sector and other-sector effects. Thus, as we predicted, each local day care center generates significantly more competition than each nonprofit DCC does in both the nonprofit and for-profit sectors.

Hypothesis 2d predicts stronger mutualistic effects of nonoverlap density on founding at the local level. This hypothesis is supported only for the nonprofit sector where the only significant, positive effects for same-sector and other-sector nonoverlap densities originate. The pattern is identical for nonoverlap intensity, which is also predicted (Hypothesis 3d) to have stronger mutualistic effects at the local level. Thus, as we predicted, each nonprofit day care center generates significantly more mutualism at the local level than each for-profit DCC does in both nonprofit and for-profit sectors. Although support for Hypotheses 2d and 3d is found only for the nonprofit sector, this is in line with a pattern of joint support for our relative effect predictions, Hypotheses 2b–2c and 3b–3c, which predict stronger local and nonprofit same- and other-sector effects for nonoverlap density and nonoverlap intensity.

Finally, Hypothesis 4d predicts stronger nonlocal effects for POSA density, which captures institutional relations with the Children's Services Division, a government agency with a metropolitan-wide jurisdiction, and

TABLE 8
Results of Comparison-of-Means Tests: Local versus Diffuse, Same Sector[a]

Variable	Hypothesis and Predicted Direction of Relationship[b]	Local	Diffuse	Test Statistic[c]	Support?
Same-sector overlap density	1d, >				
Nonprofit		–.064 (.032)*	–.022 (.026)	18.26*	Yes
For-profit		–.090 (.045)*	–.078 (.042)*	3.00*	Yes
Other-sector overlap density	1d, >				
Nonprofit		–.172 (.051)*	–.100 (.035)*	21.82*	Yes
For-profit		–.095 (.039)*	–.017 (.030)	41.48*	Yes
Same-sector nonoverlap density	2d, >				
Nonprofit		.100 (.032)*	.008 (.025)	41.81*	Yes
For-profit		.034 (.058)	.009 (.033)		No
Other-sector nonoverlap density	2d, >				
Nonprofit		.161 (.052)*	.021 (.035)	41.18*	Yes
For-profit		.043 (.038)	–.019 (.030)		No
Same-sector nonoverlap intensity	3d, >				
Nonprofit		.011 (.004)*	–.003 (.003)	51.53*	Yes
For-profit		.014 (.010)	–.001 (.005)		No
Other-sector nonoverlap intensity	3d, >				
Nonprofit		.011 (.006)*	.000 (.005)	23.95*	Yes
For-profit		–.007 (.007)	–.004 (.003)		No
Same-sector POSA density/ POSA density squared	4d, <				
Nonprofit		–.068 (.019)*/n.s.	.053 (.017)*/–.137 (.062)*	86.43*	Yes
For-profit		.289 (.100)*/–6.883 (1.921)*	.039 (.037)/n.s.		No
Other-sector POSA density/ POSA density squared	4d, <				
Nonprofit		–.110 (.040)*/n.s.	.096 (.027)*/n.s.	79.23*	Partial
For-profit		.024 (.028)/n.s.	.034 (.018)*/n.s.	5.56*	Partial

TABLE 8 (continued)

Variable	Hypothesis and Predicted Direction of Relationship[b]	Local	Diffuse	Test Statistic[c]	Support?
Same-sector SSA density/SSA density squared	4d, >				
Nonprofit		.121 (.041)*/–.236 (.111)*	.039 (.023)*/n.s.	34.17*	Yes
For-profit		–.132 (.077)*/n.s.	–.106 (.077)/n.s.	3.81*	No
Other-sector SSA density/SSA density squared	4d, >				
Nonprofit		.205 (.060)*/n.s.	.066 (.046)/n.s.	33.10*	Partial
For-profit		–.102 (.059)*/n.s.	–.013 (.050)/n.s.		No

[a] Nonprofit same-sector coefficients are from model 4, and for-profit same-sector coefficients are from model 8. Nonprofit other-sector coefficients are from model 4. Standard errors are in parentheses.

[b] Predicted direction of relationship is from local to diffuse.

[c] If both coefficients were insignificant or the coefficient predicted to be larger was not in the predicted direction, comparison-of-means tests were not performed. The test statistic is for the coefficients for the linear term.

$*p < .05$

stronger local effects of SSA density, which captures institutional embeddedness with community-based organizations whose jurisdictions are more localized. This prediction is supported fully for same-sector effects on foundings in the nonprofit sector: the nonlocal POSA density coefficients conform to the predicted inverted-U pattern, and local POSA density has a monotonic, negative effect. This means that proliferation of these links in other cities stimulates for-profit foundings, but proliferation of POSAs with nonprofit DCCs in the same city suppresses for-profit foundings. The local SSA density coefficients also conform to the predicted inverted-U pattern, and a comparison-of-means test confirms that the positive first-order nonlocal SSA density coefficient is significantly smaller than the local first-order coefficient.

The same-sector effects on founding in the for-profit sector provide no support for Hypothesis 4d. Same-sector POSA density has the predicted inverted U-shaped effect on for-profit founding, but it is at the local-city level; same-sector SSA density has a local effect on for-profit founding, but it is purely competitive. The other-sector estimates, none of which are nonmonotonic, offer partial support, with the exception of for-profit SSA density. The generally weaker support for our relational density hypotheses in the for-profit sector is consistent with Hypothesis 4c, which predicts stronger nonprofit relational density effects.

DISCUSSION

Ecological Processes

Taken together, the ecological findings provide clear evidence of nonprofit day care centers' inclination toward noncompetition and cooperation—and of for-profit founders' exploitation of this tendency (Hypotheses 1b–3b, 1c–3c). Indeed, the effects of nonoverlap density and nonoverlap intensity arise entirely from the nonprofit sector in the DCC population. Moreover, the stimulating effect of increasing local same-sector nonoverlap density on nonprofit founding ($e^{.100}$) is larger than the suppressing effect of increasing local same-sector overlap density ($e^{-.064}$). The clear predominance of local ecological effects also supports our expectation that, in the geographically segmented day care center environment, proximity would greatly influence the potential for competition among centers with overlapping organizational niches as well as noncompetitive and cooperative interaction among those with nonoverlapping or partially overlapping organizational niches (Hypotheses 1d–3d).

Two aspects of the ecological findings are of further interest. First, effects of diffuse same-sector nonoverlap density vanish in both sectors when same-sector purchase-of-service-agreement (POSA) and site-sharing-arrangement (SSA) density measures are included (see Table 4). Thus, the diffuse mutualism revealed initially by these coefficients appears to reflect, spuriously, some effects of increasing institutional embeddedness. Second, diffuse competition significantly affects the for-profit founding rate. Although our theoretical arguments suggest that providing similar services creates competition among proximate DCCs, diffuse competition among more distant DCCs with overlapped age ranges may be produced by other scarce resources that are specific to given age ranges, but not tied to particular locations. One such resource is subsidized fees provided by the Children's Service Division, which are budgeted and allocated to families in need on the basis of the four government-defined age ranges. Another is qualified labor that is specialized in the care of children of particular ages. Thus, although we predicted and found strong local competitive effects of overlap density, it seems reasonable to also find more moderate competitive effects of diffuse overlap density—especially among for-profit founders, who tend to be more attentive to, and more influenced by, the structure of market opportunities and competition, and who may view the proliferation of similar, but more socially fit, nonprofit rivals as an imposing deterrent to entry.

Institutional Processes

Our institutional hypotheses also received substantial support; however, the evidence is stronger in the nonprofit sector and suggests that the beneficial effects of institutional embeddedness—for both nonprofit and for-profit founding—derive mostly from the nonprofit sector. This result is consistent with our expectation that because institutional links with nonprofit day care centers are normatively ratified, relational density effects would be stronger among them (Hypothesis 4b), and for-profit DCCs would benefit more from the increasing institutional embeddedness of the nonprofit DCCs than from their own (Hypothesis 4c).

What accounts for the nonconforming for-profit findings? The purely competitive same-sector SSA density effect suggests that for-profit founders view for-profit day care centers with site-sharing arrangements as imposing competitors and a strong deterrent to entry. The purely positive effect of other-sector SSA density implies that for-profit founders are (intentionally or accidentally) institutional free riders (Baum & Oliver, 1992). That is, they benefit from the legitimating and stabilizing benefits obtained from membership in an institutionally embedded population but are not interested in initiating institutional ties themselves. This interpretation is consistent with the lower likelihood (compared to nonprofit DCCs) that for-profit DCCs will establish site-sharing arrangements (see Figure 3). The strong locally competitive other-sector POSA density effect may reflect the tendency of for-profit DCC founders to target low-income neighborhoods with the intention of drawing their enrollment from the pool of families receiving child care subsidies from the Children's Services Division.[10] Thus, for-profit founders may commonly seek to fill gaps in the spatial distribution of subsidies.

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[10] Personal communication, John Mitchell, Municipality of Metropolitan Toronto, Children's Services Division.

For-profit DCC founders may thus tend to view POSAs more as a direct resource than as a source of external endorsement.

Control Variables

The environmental control variables also have several notable influences on DCC founding rates. Supporting the view of for-profit founders as concerned with the viability of their new organizations, high interest rates suppressed for-profit founding but did not affect nonprofit founding. Also consistent with this view, for-profit foundings were influenced strongly by local demand. Nonprofit foundings, however, were influenced by the demand for child care throughout the metropolitan area, perhaps reflecting their responsiveness to broader social trends and needs. Furthermore, larger Children's Services Division budgets stimulated only for-profit DCC foundings. This puzzling effect may result from the tendency of for-profit founders to target neighborhoods in which the number of families receiving child care subsidies is high. Lastly, both nonprofit and for-profit foundings are more likely when the supply of early childhood education graduates is large.

CONCLUSION

In this article, we have attempted to extend organizational ecology in four ways: by providing a model of founding processes bridging ecological and institutional explanations; by showing how interactions between organizations' resource overlaps and nonoverlaps facilitate stable coexistence among potential competitors in a multidimensional organizational niche space; by providing evidence that nonprofit and for-profit entrepreneurs are affected differently by the ecological and institutional environments confronting them; and by demonstrating how the effects of ecological and institutional processes on organizational foundings operate systematically at multiple levels of analysis.

The study provides clear support for the hypothesized effects of ecological and institutional processes on founding rates in a day care center population. Ecological processes operated most strongly among neighboring DCCs and differentially influenced foundings in nonprofit and for-profit sectors. Institutional effects operated simultaneously at different levels of analysis, and the level of analysis at which they were felt most strongly depended largely on the jurisdictions of social actors providing support. In addition to these moderating effects of profit orientation and level of analysis, the nonoverlap intensity results extend our organizational niche model of organizational founding (Baum & Singh, 1994a). Here, we predicted and found relative as well as absolute effects of overlap and nonoverlap densities on founding. This result highlights a potentially basic feature of ecological processes in a multidimensional resource space: competition in overlapping organizational niche segments fosters cooperation in other, nonoverlapping segments. Thus, interorganizational cooperation is strengthened when it is combined with an element of competition. Taking on questions about how interorganizational competition and coexistence interact in a multidimensional resource space represents a very important future direction for ecological research.

The evidence of geographically localized ecological effects on founding rates suggests the need for similar research on failure rates. For example, Carroll and Wade speculated that "[l]egitimation and competition manifest themselves more strongly at different levels of analysis for mortality and founding. For instance founding processes may be more localized" (1991: 272). Further study of the geographic segmentation of environments can shed new light on intrapopulation competitive processes and the potential for population dependence on the local area environment for resources and output demand. Research on spatial boundaries can also examine regulatory interventions that tend to bound or constrain the sectors in which organizations compete or the number and concentration of organizations permitted to enter a population. Future research might also examine the potential for noncompetition and cooperation at a local level, especially when geographic proximity makes it easier for organizations to share resources or develop cooperative relations. Moreover, our results, which provide evidence of institutional embeddedness operating simultaneously at both local and diffuse levels of analysis, contrast with the common view of ecological processes as subordinate to institutional processes (Scott, 1987; Singh, 1993; Tucker, Baum, & Singh, 1992; Hannan et al., 1995). This finding indicates the need for future research examining institutional effects not only at broad contextual levels but also at local community levels. Overall, our findings indicate that the analysis of spatial heterogeneity in ecological and institutional processes needs to be central to the research agenda in organizational ecology.

Although theorists' arguments help to explain which organizational populations are likely to develop nonprofit sectors (for an excellent review, see DiMaggio and Anheier [1990]), their capacity to explain variation in nonprofit and for-profit activity over time is limited (DiMaggio & Anheier, 1990). Our institutional ecology analysis contributes to an explanation of precisely this question. In the DCC population, the comparative success of the nonprofit sector (see Figure 3) resulted in part because (1) nonprofits were more inclined to cooperate than compete, facilitating their expansion, (2) nonprofits' greater social legitimacy made them more formidable competitors, impeding the expansion of for-profits, and (3) nonprofits invested in institutional links that stimulated further nonprofit growth. Thus, not only do nonprofit and for-profit organizations behave differently, but the bases for their competitive effects differ—external social legitimacy characterizes nonprofits, but intrinsic competitiveness characterizes for-profits. Furthermore, our results provide evidence supporting what we call institutional free-rider effects (Baum & Oliver, 1992). For-profit founders took advantage of the increased legitimacy and stability of the population that accompanied the increasing embeddedness of nonprofit DCCs in the institutional environment. Although our findings differ by sector, they do not support a strictly sectoral view of organizations that emphasizes the distinction between market-driven (i.e., for-profit) and institutionalized (i.e., public and nonprofit) sectors. They do, however, clearly show that nonprofit and for-profit founders respond differently to elements of the ecological and institutional environment, suggesting that nonprofit and for-profit sectors have different underlying "institutional logics" (Powell, 1991: 200).

A final, and more general, line of inquiry suggested by this study is the link between organizational ecology and entrepreneurship. Little work has been done to explore this link, perhaps because organizational ecologists have focused primarily on the population level of analysis (Baum & Singh, 1994a). Researchers in entrepreneurship are interested in how entrepreneurs' initial strategic choices and socioeconomic conditions affect the identification of market opportunities and creation of organizations to pursue them (Aldrich & Wiedenmayer, 1993; Guth & Ginsberg, 1990). Incorporating information on intrapopulation niche structure and the spatial boundaries of environmental processes permits researchers to address these questions directly. Entrepreneurs' choices of organizational niche and location, together with the distribution of competing and complementary organizations in a population and the level of institutional embeddedness, affect founding probabilities significantly. Thus, our results illustrate how the dynamics of ecological and institutional processes define the conditions that favor or inhibit entrepreneurship.

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APPENDIX
Multiplier Effects

As noted, we tested our hypotheses by examining the relative slopes of effects, but another way to conceptualize the strength of a variable's effect is by its magnitude. This "collective" view requires hypothesis tests comparing relative effect sizes at various observed levels of the variables. Such comparisons permit examination of the possibility that even though, for example, a coefficient for diffuse overlap density is significantly smaller than a coefficient for local overlap density, the diffuse coefficient eventually produces a larger effect size because there are more niche overlaps to be added.

Comparing magnitudes of effect sizes can be accomplished by translating coefficient estimates into multipliers of the founding rate (e.g., Haveman & Cohen, 1994: 142). Rate models are multiplicative rather than additive. The magnitude of the impact of any continuous variable X on the founding rate can be represented as *multipliers*, which are calculated as $e^{\beta X}$, where β is the coefficient estimate and X is some value of the variable. Calculation of multipliers for each significant ecological and institutional variable at both the mean and maximum observed values permits comparison of average and largest magnitudes for nonprofit and for-profit and local and diffuse measures. A table showing full results of these calculations is available upon request; partial results are discussed here. A multiplier of more (less) than 1 indicates that the founding rate is increased (decreased) by an amount equal to the multiplier. For example, a multiplier of 1.2 (0.8) calculated at the mean of a variable translates into an average increase (decrease) of 20 percent in the founding rate. Here, we only examine support for a subset of our hypotheses (Hypotheses 1b, 1c, 1d, 4c, and 4d) for which coefficients for both variables to be compared are significant. Of course, in cases in which the coefficient for only one variable is significant the comparison is implicit; the magnitude of the significant variable's effect size is larger.

Supporting Hypothesis 1b, mult_μ for same-sector local overlap density is smaller in the for-profit sector (0.867) than in the nonprofit sector (0.899), indicating a stronger average local competitive effect in that sector. However, the values for $\text{mult}_{\max}$ are comparable (0.683 and 0.676). This means that, although a unit of niche overlap with a nonprofit DCC has a weaker competitive effect than a unit of niche overlap with a for-profit DCC, because there are many more nonprofit overlaps, the smaller coefficient produces a larger maximum multiplier.

Supporting Hypothesis 1c, mult_μ and $\text{mult}_{\max}$ for other-sector local overlap density are both smaller in the for-profit sector ($\text{mult}_\mu = 0.752$, $\text{mult}_{\max} = 0.349$) than in the nonprofit sector ($\text{mult}_\mu = 0.860$, $\text{mult}_{\max} = 0.669$), indicating a stronger local competitive effect of nonprofits in the for-profit sector. However, failing to support Hypothesis 1d, mult_μ and $\text{mult}_{\max}$ for same- and other-sector diffuse overlap density are both smaller than the multipliers for their local counterparts in the for-profit sector, indicating a stronger diffuse competitive effect. Thus, even though a diffuse unit of niche overlap has a weaker competitive effect than a local unit, because the number of diffuse niche overlaps is generally much larger, the smaller coefficient produces larger average and maximum multipliers.

Supporting Hypothesis 4c, mult_μ and $\text{mult}_{\max}$ for other-sector diffuse POSA density are both much larger in the for-profit sector ($\text{mult}_\mu = 2.695$, $\text{mult}_{\max} = 8.721$) than in the nonprofit sector ($\text{mult}_\mu = 1.294$, $\text{mult}_{\max} = 1.461$), indicating a stronger diffuse stimulating effect of nonprofit DCC with POSAs on founding in the for-profit sector. Supporting Hypothesis 4d, mult_μ for same-sector effect of local SSA density is larger (1.950) than mult_μ for same-sector effect of diffuse SSA density (1.600) in the nonprofit sector. $\text{Mult}_{\max}$ is larger for the diffuse effect; however, this comparison of $\text{mult}_{\max}$ is "unfair" in the sense that it contrasts a quadratic local effect with a linear diffuse effect.

Thus, with one exception, our hypotheses appear generally robust to this alternative interpretation of the strength of a variable's effect.

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LIFE AND DEATH ALONG GASOLINE ALLEY: DARWINIAN AND LAMARCKIAN PROCESSES IN A DIFFERENTIATING POPULATION

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Despite the topic's centrality to theorizing in organizational ecology, no study has examined in detail how founding, failure, and transformation events combine over time to achieve population-level change. We examined Darwinian and Lamarckian processes of population reconfiguration within the gasoline retail industry at two nested levels of analysis, studying both individual outlets and parent companies. Our findings demonstrate how Darwinian processes at the unit (outlet) level may lead to Lamarckian adaptations at the organization (company) level through purposive replication of successful forms.

> The major gaps in our understanding of organizational change concern the actual dynamics . . . In particular, how much of the change in the organizational world comes about through tinkering (adapting organizational strategies and structures) and how much through replacement of one kind of organization by another? We are just beginning to learn about the relative rates of the various processes, which are crucial to answering this question (Hannan, 1986: 80).

The underlying concern addressed here is a familiar one to organization theorists. At issue are the relative contributions of two fundamental processes that work toward the reconfiguration of populations of organizations: selection/replacement, and transformation. The debate centers around the extent to which changes in the form of existing organizations are, or are not, significant in long-run changes at the population level. This study follows calls by several researchers to move beyond merely debating this issue to-

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ward examining empirical regularities within specific populations. For example, Aldrich and Marsden concluded that "the theoretical dispute in this area has not been matched by a corresponding volume of research results" (1988: 380). Similarly, Winter noted that "arguing about the generalizations is less interesting than sorting out the cases and testing the strength of competing interpretations" (1990: 293).

In this article, we examine the strength of these competing explanations for reconfiguration in a single population: gas stations in the City of Edmonton, in Alberta, Canada. Examining the actual foundings, failures, and transitions that occurred in this population and seeing how they compared with the frequencies predicted under either a pure selection/replacement model or a pure change model yields some idea of how population change occurred in this population. Comparison of these rates with those established by other investigators will help rebut the complaint of Aldrich and Marsden (1988) and fulfill the injunction of Winter (1990). We should emphasize that this work focuses on population phenomena: the joint contribution of selection/replacement and transition to change in a population. It does not focus on the underlying factors affecting individual organizations that contribute to these rates. These organization-level processes are fully described in earlier work (Usher, 1990, 1994).

To some extent, the relative lack of empirical research in this area might be explained by factors that militate against a necessary part of such work: the study of organizational change itself. For example, Singh and Lumsden (1990) argued that certain of the conceptual underpinnings of organizational ecology (inertia and the population perspective) direct the attention of researchers away from organization-level changes because they are judged to be infrequent events of secondary importance. Further, these authors suggested that access to quality data on internal organizational changes may be a limiting factor given the large number of organizations and broad sweep of time typical of such studies. This point echoes an earlier one made by Aldrich and Pfeffer, who noted that "modifying the natural selection model in this fashion complicates an ecological analysis, since the criterion for successful adaptation to the environment is changed from the easier-to-observe survival or failure to the more problematic criterion of structural change or stability" (1976: 9).

Despite these problems and pitfalls, however, a respectable number of scholars have begun to explore the topic of organizational change in a rigorous and sophisticated manner. Baum (1996) provides an excellent overview of this work. Thus, in some research authors have considered a number of internal and external influences on rates of change in organizations, such as organizational age and size, the repetitive momentum of change, and the influences of various contemporaneous changes in organizational environments (Aldrich & Auster, 1986; Amburgey, Kelly, & Barnett, 1993; Delacroix & Swaminathan, 1991; Ginsberg & Baum, 1994; Haveman, 1994; Singh, Tucker, & Meinhard, 1988). In other research, authors have explicitly considered the roles of all three vital rates (organization foundings, organization change, and organization mortality) in the determination of population-level outcomes (Alexander & Amburgey, 1987; Baum & Singh, 1993; Delacroix, Solt, & Swaminathan, 1989; Haveman, 1992; Kelly & Amburgey, 1991; Levinthal, 1991, 1994; Miner, Amburgey, & Stearns, 1990; Singh, House, & Tucker, 1986).

Despite this burgeoning research output, however, certain fundamental questions remain unanswered. Perhaps the most obvious empirical gap, given the nature of the selection versus transformation debate, consists of data on the actual gross rates of each process and how they combine in practice. That is, given a change in diversity of forms in a population, what are the relative contributions of selection/replacement and transformation to that change? Of the authors cited above, only Alexander and Amburgey (1987) expressly set out to understand how founding, failure, and transformation at the organization level have combined to create change at the population level. Despite developing a useful conceptual model, however, they were unable to pursue the matter empirically because of data limitations in their population of U.S. hospitals.

Our objective in the study reported here was to pursue this broader perspective by empirically assessing the balance of these processes in a real population undergoing a substantial reconfiguration of internal forms. We began with the assumption that both processes—selection and transformation—have nontrivial impacts on the diversity of forms within a given population. We then explored the role of these dynamics within a broader population-level change perspective: evolutionary theory based on both Darwinian and Lamarckian processes (McKelvey, 1994).

The population in question included all locations in Edmonton, Alberta, from which gasoline was available for retail sale at any time between 1959 and 1988. The study captures this population from a point in time at which there was relative homogeneity of form: In 1959, 94 percent of the establishments in the population had the same structure, performed the same functions, and shared the same basic competencies. It was the era of the quintessential gasoline station depicted in the films *American Graffiti* and *Back to the Future,* with two pump islands, two garage bays, tires, batteries, and accessories (TBA) sales, and pump jockeys. This homogeneity of form may reflect a concentration of affiliation in the population: Four oil companies with more than 10 percent each of the Edmonton market had 64 percent of the outlets (British American, Imperial Oil, Shell, Texaco), 32 percent of the outlets were part of the retail chains of six smaller firms (Anglo American Exploration, Great West Distributors Limited, North Star, Royalite, Canadian Oils Co., and Husky), and the remaining 4 percent were operated by ten single-station independents.

Over the course of the next 30 years, however, new forms arose and began to proliferate in substantial numbers. By 1988, only 28 percent of the population held the original, dominant combination of competencies, and three new forms, gas bars (gas sales only), convenience stores (gas sales plus convenience retail), and gas stations with automatic car washes each accounted for 20 percent or more of the total number of establishments. These changes appear not to be attributable to any accompanying proliferation at the oil company level, as the total number of major and minor firms was limited to a range of 10 to 15, and independents never accounted for more than 5 percent of the population of outlets.

We argue that the changes that took place in individual stations constituted new forms within the gasoline retail population in terms of Hannan and Freeman's definition of the core attributes of an organization:

> (1) its stated goals—the basis of which legitimacy and other resources are mobilized; (2) forms of authority within the organization and the basis of exchange between members and the organization; (3) core technology, especially as encoded in capital investment, infrastructure, and the skills of members; and (4) marketing strategy in a broad sense—the kind of clients (or customers) to which the organization orients its production and the ways in which it attracts resources from the environment (1984: 156).

Although it is clear that nothing so fundamental as implied in Hannan and Freeman's first point took place, we argue that points 2, 3, and 4 are useful for understanding why each of the new forms in the population differed significantly from the service station origin state. Fundamental to that difference is that nearly all of the transitions out of the service station form (into gas bar, convenience store, or car wash) involve the loss of an outlet's vehicle repair bays. The addition to existing facilities of a car wash or convenience retail use without simultaneous discontinuation of vehicle servicing is relatively rare, occurring in less than 5 percent of the transitions out of the service station form. In most cases, loss of repair bays was due to space constraints. These hybrid stations are designated as "mixed uses." Classification is discussed in more detail in the Methods section of this article.

By definition, then, none of the three main destination states—the gas bar, the car wash, and the convenience store—is a "service" station any longer, as the core technology of the origin state defines it. Furthermore, this loss of the skilled labor, tools, equipment, and inventories of parts typical of gas station service bays has important repercussions for other important form-defining characteristics. First, in general terms, these new forms have no continuing need for coordination or scheduling of work (discrete "repair jobs") and the ability of employees to use the tools and facilities of the station to work on their own vehicles (as a supplementary basis of exchange) is curtailed. Also, all three of the alternate forms are far more concerned with capturing customers opportunistically from nearby traffic flows than with building reputations for service in their immediate neighborhoods; an important change in marketing strategy has occurred. More specifically, with its primary emphasis on gasoline sales and no requirement for on-site management, the gas bar form is also the most likely to be owned and operated by the oil company itself, rather than franchised. Modern, automated car washes represent a much larger fixed investment than a standard gas bar, but typically have no on-site service personnel and are managed by the gasoline retail cashier. Typically, car washes act as traffic builders and contribute little, if any, direct profits from wash sales. The convenience store adds the additional managerial complexity and inventory cost of handling over a 100 product categories instead of the TBA (tires, batteries, and accessories) of the other forms. Superficially, these new outlets are still gas stations, but in view of the changes in core technology, forms of authority, basis of exchange, and marketing strategy, we argue that they constitute new forms within the gasoline retail population.

But the perennial question underlying the selection/transformation debate is, of course, how does a population get from relative homogeneity (1959) to heterogeneity (1988)? Proponents of an adaptationist view would suggest that most of the stations thriving in 1988 were the same stations operating in 1958. Many had given up their repair bays, some had added convenience stores, some car washes. This process is depicted in the upper half of Figure 1, showing individual establishments changing from time 1 to time 2. Proponents of a strong selection approach would argue that large numbers of gas stations in the new, more viable forms were founded into the population, replacing equally large numbers of failing old-style garages (lower half of Figure 1). Anyone who has driven a car during the last one or two decades knows that each position contains some truth; the reality is a middle ground between these two interpretations.

Before attempting to empirically locate that middle ground for this population, however, we recast the arguments from each side within a more precise population-level framework using Darwinian and Lamarckian processes of population change (McKelvey, 1994). This process gives rise to a discussion of issues of the appropriate level of selection and the temporal sequencing of events. We then examine the population and methodological concerns related to the measurement of selection, replacement, and transformation events. Next, we derive estimates of the numbers of founding, failure, and transformation events necessary to alter the form mix of the population of gas stations over the period from about 1958 through about 1988 under the strict assumptions of Darwinian and Lamarckian change at the unit (outlet) level and at the organization (oil company) level. These positions are constructed to represent the external limits of Weberian ideal types between which the observed empirical reality can be calculated and positioned for comparative purposes.

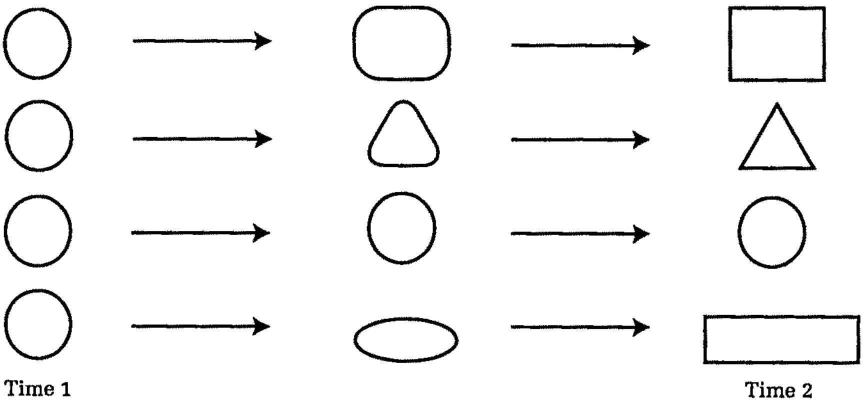
THEORETICAL BACKGROUND

Adaptation Models and Lamarckian Change

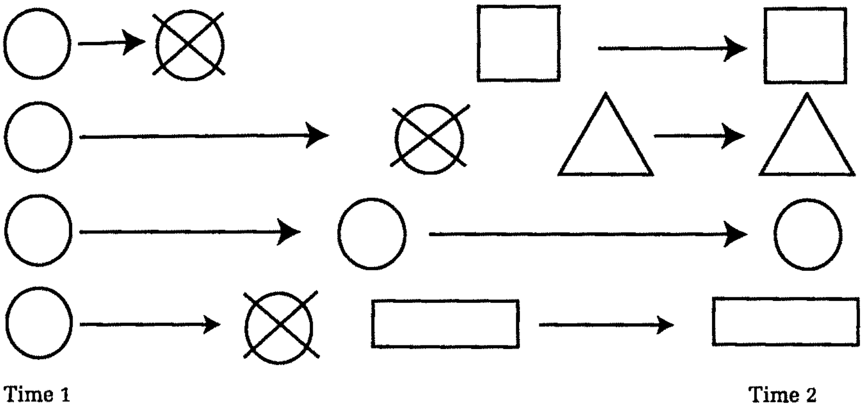
Singh, House, and Tucker (1986) identified adaptive or transformational models as positing either intentional or unintentional organizational action. Contingency theory, resource dependence theory, and institutional theory

FIGURE 1
Role of Organizational Change in Population Change

(a) Organizational Adaptation



(b) Selection/Replacement



are the primary "intentional" models, and "garbage can" models and theories of emergent strategy are "unintentional" models. Levinthal (1991, 1994) drew a similar distinction with respect to adaptive learning on the part of organizations experiencing both planned and unplanned changes. Whether changes are intentional or unintentional, managers view the outcomes of these changes and selectively retain those that they believe will be most beneficial, thus effecting changes in individual organizations. Population-level change thus primarily involves aggregated organization-level transformations as managers realign organizational routines to suit emerging changes in relevant environments. As McKelvey noted, "Via the Lamarckian process, an organizational population changes as existing members adapt to environmental pressures by replacing less favored comps[1] with more favored comps" (1994: 316).

Expectations for a particular population would be that a net loss in the number of organizations would arise primarily from transformation reclassifications into the new forms enjoying greater success in the marketplace. Rates of founding and failure would not differ significantly from those attributable to the overall growth or shrinkage of the population. This last point is an important one for the comparison of actual rates in populations since transformation is, by definition, limited to organizations in an existing population and cannot, therefore, impact changes at the margin in the overall size of the population.

Selection/Replacement and Darwinian Change

Hannan and Freeman clearly laid out the tenets of this approach: "Our work approximates a Malthusian-Darwinian position on the nature of change in organizational populations over time. We think that the current diversity of organizational forms reflects the cumulative effect of a long history of variation and selection" (1989: 20). Earlier, Hannan and Freeman (1984) suggested a number of internal and external constraints on organizations that increase their relative inertia and make successful adaptive change difficult. They argued that fundamental change in core routines is not only infrequent *and* infrequently adaptive when attempted; it is also risky. Population-level change, therefore, would primarily involve the failure of unfit organization structures and the retention of new variations founded into a population that better fit an environment. Or, as McKelvey stated, "Via the Darwinian process, an organizational population changes as new members holding more favored comps compete into failure members holding less favored comps" (1994: 316).

Expectations for a specific population would be that any net loss in the number of establishments of a particular form would be primarily attributable to failures and that the majority of new forms would arise through foundings. Rates of successful transformation (survival beyond an initial period of heightened short-term risk) would be minimal.

Darwinian versus Lamarckian Processes: Units of Selection and Temporal Sequencing

Crucial to the distinction between Darwinian and Lamarckian population change is the location of the unit of selection in each approach. As Hannan and Freeman (1984) argued, the inertia of existing population members produces a level of consistent performance that is selected for in many environments. Therefore, Darwinian change depends upon the founding of new members to introduce variation into the pool of competencies held by the population (McKelvey, 1982; McKelvey & Aldrich, 1983). Each organization is a mixture of the competencies held throughout the population, but it is a mixture that is not likely to be successfully changed in fundamental ways once the organization has been founded. The *organization* is the unit of selection. New organizations that successfully "outcompete" existing organizations may then find themselves positively selected through their forms' exhibiting higher founding rates than existing forms (as entrepreneurs evaluate and imitate their competencies), or lower failure rates. Similarly, the relative success of the existing members may begin to wane as their forms are negatively selected through failure rates that are higher or founding rates that are lower than those of some newer form (Alexander & Amburgey, 1987).

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[1] "Comps" are competencies.

With Lamarckian change, the units of selection are the competencies themselves. Whether a favored competency first arises in the population in a new member or an existing member, population change will reflect the extent to which all organizations in the population subsequently adopt it. In some cases, the favored competency will simply be added to the other competencies of individual existing firms; in others, it will replace less favored competencies. Newly founded firms may substitute the new competency for an old one or, if unsure, attempt to balance risk by developing both sets of skills.

Approaching the distinction between Darwinian and Lamarckian change processes at a fixed level of analysis, however, is an oversimplication that must be addressed before the concepts can be applied in practice. As McKelvey noted, "Evolutionary principles apply at various levels of organization. Selection of trials or variations always imposes itself from the nextmost outer ring of the nesting" (1994: 325). Thus, it might be argued that the failure of an individual unit of a multiunit organization (like the individual outlets of the gasoline retail chain of an oil company) represents a Darwinian selection event for the unit itself but is a Lamarckian adaptation on the part of the larger organization. Similarly, the success or failure of these accumulated adaptations may be determined by a Darwinian process at the petroleum industry level if a particular retail outlet mix (or the competence to adaptively manage a retail mix) is critical to the survival of oil companies themselves. Our consideration of actual population data thus includes the consideration of events at both the individual unit (gas station) and organizational (oil company) levels. Table 1 summarizes our expectations for the study population in this regard.

Finally, these distinctions raise important questions regarding the temporal sequencing of the underlying processes: Does transformation of existing organizations lag behind the founding of new forms as a mechanism for form change? Alternatively, do existing organizations routinely undertake form changes, thus providing models for subsequent foundings? Do such relationships hold in all cases, or do different event frequencies and temporal patterns obtain for different transitions and different forms? Hannan and Freeman stated that "the most important issues about the applicability of evolutionary-ecological theories to organizations concern the timing of

TABLE 1
Summary of Expectations

Process	Unit Level	Organization Level
Darwinian		
Organizational population changes as new members holding more favored competencies compete into failure members holding less favored competencies.	Gas bars, convenience stores, and car washes compete service stations into failure.	New oil companies with high percentage of new forms compete into failure existing companies with an inert mix of mostly service stations.
Lamarckian		
Organizational population changes as existing members adapt to environmental pressures by replacing less favored competencies with more favored competencies.	Service stations replace the vehicle repair competency with competencies for convenience store, gas bar, and car wash.	Oil companies close or convert service stations and found new stations to increase the number of new forms in the mix. They *manage* the mix of forms.

changes" (1989: 70). McKelvey (1994) argued that the key is environmental uncertainty: The context of predictable trends experienced in relatively certain environments may support the acquisition of favored competencies by existing firms—the Lamarckian process. McKelvey suggested that such conditions might exist during periods of convergent evolution in unpunctuated (stable) environments. Under conditions of uncertainty, however, forecasting and planning are useless, and Darwinian processes will be primary determinants of population-level change. According to McKelvey, such conditions may exist when "the next punctuation is unpredictable, or the next trend in consumer taste is unknown, or the next technological breakthrough is unknown, or the predatory strategies of competitors are unknown, or the next new product wrinkle introduced by a competitor is unknown, and so forth" (1994: 321). We attempted to explore these issues.

METHODS

Population

The population studied here, all locations in Edmonton, Alberta, from which gasoline was available for retail sale at any time between 1959 and 1988, was identified through a year-by-year examination of Edmonton *Yellow Pages* listings. We verified the comprehensiveness of this approach by comparing its results against exhaustive tax reassessment lists compiled by the city for 1962 and 1982. In both years, the less than 5 percent discrepancy between lists was predominantly attributable to the existence of new stations that had missed the deadline for inclusion in the *Yellow Pages* for their actual years of founding; some discrepancy was also due to the presence of listings for stations that had actually ceased operations during the prior year. We examined the 1989 listings and corrected for these potential understatements of event types in the 1988 study year. There were 607 separate establishments operating in the population between 1959 and 1988. The stations represented outlets of 25 oil companies and of five general merchandise retailers (e.g., Sears, Canadian Tire), and 34 independents.

The city of Edmonton is the capital of the province of Alberta and home to major refineries owned by Shell, Exxon, and Petro-Canada, among others. Alberta has Canada's largest oil and natural gas reserves, and Edmonton is the location of most of the province's exploration and wellhead servicing firms. Each of the major firms' head offices, on the other hand, is located approximately 200 miles south of Edmonton in the city of Calgary, Alberta. The two cities enjoy a friendly rivalry, and the growth of each runs almost parallel to that of the other throughout the years studied; each nearly tripled in size, going from a population of approximately 280,000 in the late 1950s to close to 750,000 in the late 1980s.

The rapid growth of Edmonton and its close ties to the oil industry may present some concerns with respect to the generalizability of the study's findings. Alberta has for years enjoyed some of the least expensive gasoline in Canada, and its flat topography has not constrained the growth of the city in any way. The western ethos of "wide, open spaces" has also limited the overall urban density. Perhaps as a result of such factors, Edmonton is an above-average consumer of gasoline, as a comparison of per capita consumption with that in other urban centers of comparable size indicates. This high consumption has had the effect of increasing the overall carrying capacity of the environment, potentially decreasing the intensity of selection pressure (Alexander & Amburgey, 1987) on gas stations relative to pressure in other cities and reducing observations of failure events.

But Edmonton's closeness to sources of petroleum supply has also had the effect of permitting a great number of small firms to enter the retail gas industry. Since liabilities of size have been found to increase the failure rate of organizations in several populations (Baum, 1996), this influence may tend to act in the direction opposite to that of the previous effect. Failure rates may in fact be greater than those found in comparison cities because of the large numbers of small chains and unaffiliated stations in Edmonton. Estimation of the relative size of these potentially countervailing factors is beyond the scope of this article but would merit examination in a comparative study. In general, however, many of the broad effects that influence the vital rates in this population do appear to have parallels in many other centers across North America. We address these factors below.

Why Study Gas Stations?

For a number of reasons, gasoline service stations are particularly amenable to a study of this nature. First, the dramatic changes in both the diversity and distribution of forms in this population over the 30 years in the study provide a rich set of events in a relatively short period of time. Starting at a time in which the standard service station configuration was far and away the dominant form in the population, the period has witnessed the proliferation of a wide variety of alternatives: the addition of convenience stores, use of kiosks instead of service bays, and additions of rapid drive-through lubrication, robot car washes, and even automated banking machines. For example, in 1958, the 130,000 motor vehicles in Edmonton, Alberta, were served by 262 service stations, 1 general store with gas pumps, 1 car wash with pumps, and 15 mixed uses outlets. By comparison, in 1988, its 390,000 vehicles were served by 104 service stations, 73 convenience stores with pumps, 73 gas bars, 84 car washes with pumps, and 40 mixed use outlets. Figure 2 illustrates these changes in the diversity of forms and in the distribution of population members across these forms for the period studied.

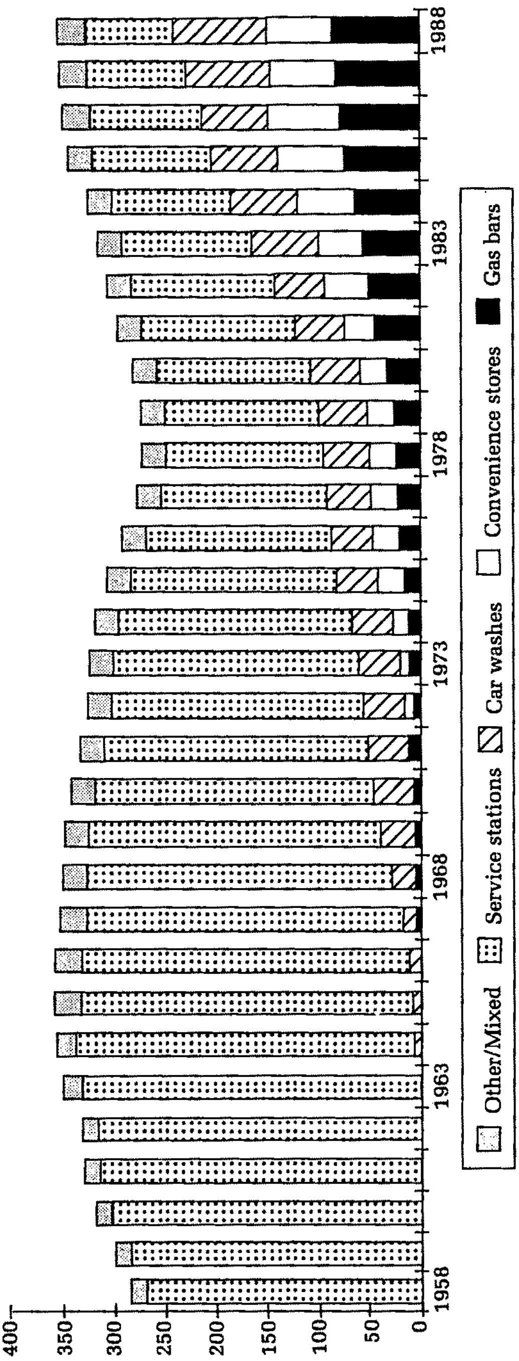
Second, the reconfiguration of this population has involved substantial numbers of both transformation and selection events. These changes parallel similar reconfigurations across North America. Industry estimates for the United States contained in the 1988 *National Petroleum News Factbook* indicate that in 1972, gasoline retail sales took place in 226,459 conventional service stations nationwide. By 1988, however, only 127,300 conventional stations remained, with 55,700 convenience store and mass merchandiser outlets and 3,000 truck stops contributing additional capacity to the industry. Although information on form conversions is not available at this level of analysis, a 1976 estimate by the American Petroleum Institute showed that in 1974 and 1975, 392 new outlets were constructed and 12,273 outlets were permanently deactivated.

A third reason to use a population of gas stations is that if population density drives the transformation of organizations, a process resulting in differentiation (Delacroix et al., 1989; Durkheim, 1947; Hawley, 1986; Usher, 1990, 1994), it is beneficial to identify a population of organizations that approached, if not exceeded, the carrying capacity of its niche during some period of time. The competitive forces arising from niche crowding would presumably be quite evident under such circumstances. Gasoline service stations appear to constitute such a population. According to a report in a 1964 *Oil and Gas Journal,* "[T]here's a growing complaint that far too many stations are being opened. Reports from the U.S. Department of Commerce indicate that the number of service stations in the U.S. has increased by about 50% during the past 8 years. About 40% of the stations surveyed had been open less than 5 years" (Burke, 1964: 38).

This explosion of service station populations was particularly noticeable in large urban areas. As one commentator noted, "Overbuilding . . . is often cited as a basic cause of sick stations. The charge is most often made in metropolitan markets. One estimate is that Detroit could do well with one-third fewer stations than its 3,900 unit total. Chicago is 25% overbuilt, a local marketer says" (Sosenko, 1964: 50). In Alberta, where this study takes place, a provincial task force on gasoline retailing (McKenzie, Fitzpatrick, &

FIGURE 2

Change in Diversity and Distribution of Population Forms in Gasoline Retail, Edmonton, 1958–88



Rose, 1968) made estimates, for 1965, of the number of stations the populations of the two largest cities in the province could reasonably support. The task force developed an economic model of an average station based on the return of an acceptable level of profit to the station operator. Using this model and gasoline consumption figures, the task force estimated that Edmonton required only 233 of its 362 existing outlets and Calgary, only 196 of its 369 (McKenzie et al., 1968).

A further reason supporting a study of this population is that theories of Darwinian and Lamarckian population change incorporate environmental uncertainty as a fundamental element. The fact that this population moved from a relatively stable, homogeneous state into intense, selective discrimination suggests that it may have experienced a punctuated episode in its environment following a period of convergent evolution (Tushman & Romanelli, 1985). As McKelvey noted, the types of environmental changes associated with such "k to r shocks" include competence-destroying technological changes (Tushman & Anderson, 1986), but they may also involve economic recession, government deregulation, and dynamics in adjacent industries.

Beginning in the late 1960s and extending through the 1970s, a large number of changes have taken place in the service station environment. Some have been gradual changes relating to the vehicle repair business, once the main profit generator of the conventional station: Increasing repair complexity and foreign vehicle market penetration created onerous training and inventory demands. Extended factory warranties, changing vehicle owner demographics (more women), and media exposés of corrupt repair practices have also moved many consumers away from corner garages toward dealerships and nationally franchised repair specialists. Other changes have been less gradual, such as the oil shocks of 1974 and 1979. In oil patch areas such as Texas and Alberta, such shocks translate into boom-and-bust cycles of exploration, largesse, and famine. Such local effects often run counter to the broader national experience of these events. Also of import to the population have been legal changes permitting consumer self-service of gasoline.

Finally, merger activity also had a prominent impact on this population over the course of the study, with a total of 12 companies being absorbed into larger firms. The resulting pressure for the rationalization of affiliated retail facilities likely added substantially to both change and failure rates at the service station level. In fact, a preliminary analysis of factors impacting rates of change and failure in this population (Usher, 1994) found that participating in a merger in the previous year was among the strongest positive influences on both change and failure for individual stations.

Finally, the fact that service stations occupy bounded retail spaces reduces the difficulty of obtaining good transformation data experienced in many research efforts. Applications to change the land use at such locations in the city are recorded in Edmonton Planning and Development Department building files. There is a file for each distinct address in the city, and owners are required to submit paperwork if a change of land use is contemplated. City planners can thus monitor land uses with respect to location zoning. Since a service station is a potentially noxious land use because of traffic, noise, fumes, fire hazard, and so forth, applications for either initial construction or subsequent modification are closely scrutinized. Follow-up paperwork records various inspections made as the proposed work is carried out. The building file begins with the first nonvacant use of a given location and moves forward. This system thus maintains an excellent paper trail of change events for the entire population. Also, as discussed in more detail below, land uses provide a classification mechanism for both the unambiguous determination of population membership and the construction of a state space within which to monitor inter- and intrapopulation transitions.

Classification Based on Competencies

There are various approaches to the problem of classifying organizations (Blau & Scott, 1962; Haas, Hall, & Johnson, 1967; McKelvey, 1982; Pugh, Hickson, & Hinings, 1969; Woodward, 1958). This study follows the lead of Alexander and Amburgey (1987) and those researchers (McKelvey, 1994; McKelvey & Aldrich, 1983; Pinder & Moore, 1979; Romanelli & Tushman, 1986) who have argued that only through empirically grounded studies of specific populations can organization scientists begin to integrate findings and achieve the broader generalizability of middle-range theory. As McKelvey and Aldrich (1983: 119) recommended, (1) we chose a clear, common-sense group, gasoline service stations; (2) sampling within the group was narrow and intensive, with all of the retail gas outlets operating in Edmonton selected; and (3) enough information was gathered on the environment and niche of the target group that meaningful classificatory and ecological analyses could be undertaken. As McKelvey argued, "A local population in a specific niche is the only basic unit for scientific generalization that we have" (1994: 317).

The City of Edmonton Land Use Bylaw states that "The Use Classes group individual land uses into a specified number of classes, with common functional or physical impact characteristics" (City of Edmonton, 1988: a24). The Land Use Bylaw is thus a mechanism through which the city attempts to reconcile the separate needs embodied in three general use categories.

The commercial use classes, however, do have the potential to constitute a taxonomy of service and retail organizations. There are 41 commercial use classes, some as broadly different as "cremation and internment services" and "carnivals," others as similar as "animal hospitals and shelters" and "veterinary services, minor." Since retail sale of gasoline is a necessary condition of population membership for this study, all organizations either founded or migrating into the population are engaged in the commercial use "gas bar." In addition, consistent with the clustering of routines (Nelson & Winter, 1982) and highly probable combinations of competence elements (McKelvey, 1982), many stations represent use-class aggregations. For example, a standard service station is defined as a gas bar in combination with an automotive and equipment repair shop. Thus, in Figure 3, the competency (McKelvey, 1982) for gasoline retail is at the center, with the various ancillary use classes shown as overlapping this core element. Based on oil industry sources and the empirical record, these ancillary uses include (1) body repair and paint shops, (2) automotive and equipment repair shops, (3) automotive sales/rentals, (4) rapid vehicle drive-through services, (5) minor eating and drinking establishments, (6) convenience retail stores, (7) convenience vehicle rentals, (8) drive-in food services, and (9) general retail stores.[2]

As Figure 3 shows, the various use-class combinations of the population used in this study are (1) the core competency of gasoline retail in its stand-alone form is called a gas bar, (2) the combination of automotive and equipment repair and the retail gas competency is a service station, (3) the combination of rapid drive-through vehicle services and the retail gas competency is a car wash, (4) the combination of convenience retail store and the retail gas competency is a convenience store, and (5) the combination of any other ancillary use with the retail gas competency or any admixtures of the four primary forms is called other/mixed.

A Transition Model for Population Dynamics: Defining Transformation and Selection Events

In studies of organizations, niche is often operationally defined as a product market or industry. For example, Tushman and Anderson (1986) spoke of "niche openings" for the first firms producing Portland cement, operating airlines, and manufacturing minicomputers. Delacroix and colleagues (1989) consider the "initial niche" in the post-Prohibition California wine industry to be the production of dessert and fortified wines, with later movement into table wines representing a niche enlargement.

To the extent that such changes substantially impact capital investment, technical infrastructure, member skills, and relevant markets, the addition and deletion of whole lines of business represent core changes (Hannan & Freeman, 1984) that may move organizations from one population form to another. Such transformation events were recorded in this study at the unit level when land use changes revealed an increase or decrease in the number of areas of activity at an individual outlet. For example, a land use change from a minor service station to a gas bar would be classified as a transformation since vehicle repair would no longer be part of the organization's

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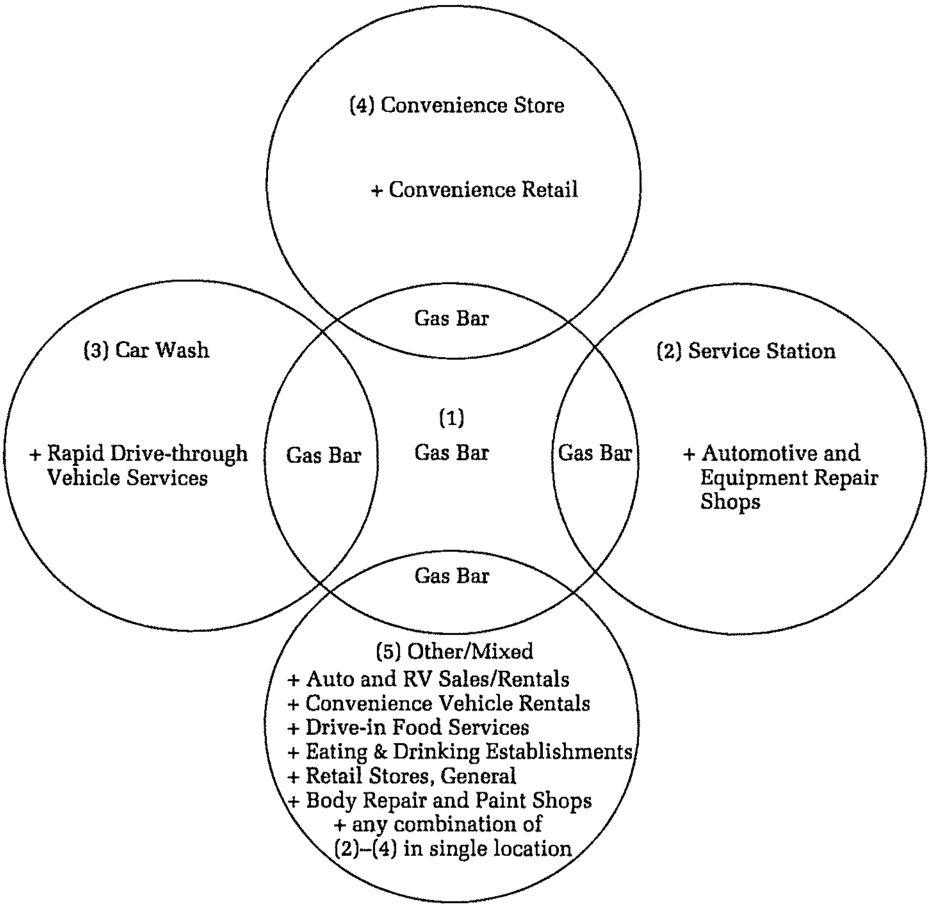
[2] Population membership for the purposes of this study requires each establishment to have the retail gasoline competency. Technically, this is a methodological convenience that is inconsistent with the normal definition of a polythetic group: "No organization holds all of [the competencies in the population], and no single comp is held by all organizations" (McKelvey & Aldrich, 1983: 112). It would have been more accurate to call the focus of this study the vehicle services population and include all car washes, repair shops, and so forth, whether they pumped gas or not. As the current project was already substantial, however, this expansion was deferred.

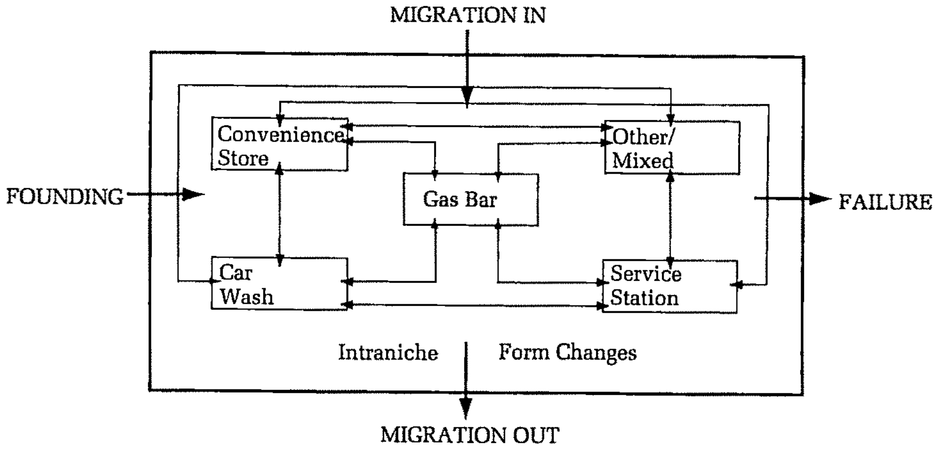
FIGURE 3
Classification of Organizational Forms


(4) Convenience Store
+ Convenience Retail
Gas Bar
(3) Car Wash
+ Rapid Drive-through Vehicle Services
Gas Bar
(1)
Gas Bar
Gas Bar
(2) Service Station
+ Automotive and Equipment Repair Shops
Gas Bar
(5) Other/Mixed
+ Auto and RV Sales/Rentals
+ Convenience Vehicle Rentals
+ Drive-in Food Services
+ Eating & Drinking Establishments
+ Retail Stores, General
+ Body Repair and Paint Shops
+ any combination of (2)–(4) in single location

activity set. Similarly, acquiring an additional land use, such as convenience retail stores, would also represent a form change. These change types are shown as movement between forms in the center of Figure 4.

As noted above, the realized niche for the current study should include the domains of all vehicle service organizations regardless of whether they hold the retail gas competency. To avoid unnecessary complexity, however, we used the retail gas competency to define the initial, or focal, niche and used the ancillary use classes to define the niche spaces adjacent to it. This construction permitted us to define migration—lateral movement into a neighboring niche (Delacroix et al., 1989)—as the abandonment of gasoline retail in favor of one or more of the ancillary use niches (the outer circles in Figure 3). In a true polythetic grouping, there would be no need to differentiate migration from other form changes as no single competency would

FIGURE 4
A Transition Model for Population Dynamics in the Gasoline Retail Niche



define the population. Figure 4 shows migration out of the focal niche as an alternative to failure, which results in an establishment leaving the population. It should also be noted that migration into the focal niche is an alternative to founding as a means of entering the population. Although the special nature of migration does have implications for the estimation of its rates of occurrence in this population (Usher, 1994), for the purposes of calculating the gross rates in this study, we treated migrations-in as foundings and migrations-out as failures, since these are the essential impacts on the distribution of organizations across the relevant forms. There were a total of 8 migrations into the population (only 1 of which had service stations as its destination state) and 32 migrations out of the population (20 involving service stations).

The definition of transformation inevitably raises a thorny question: How much change can take place in an organization before the starting and ending states can no longer be considered to be the same organization? We acknowledge that owners can and do alter the forms of their organizations from time to time. In fact, it is argued here that the physical artifacts of an organization can be completely destroyed, but if there is a resumption of the core productive routines (here defined as gasoline retail sales) after rebuilding, the organization has continuity. This approach reflects industry practice. A 1976 American Petroleum Institute study of service station foundings and failures notes that foundings do not include "rebuilds" on existing sites, regardless of the extent of change involved. This approach is also consistent with the following statement by Winter: "Considered as a repository of knowledge of the sort that is 'remembered by doing,' an organization (qua package of competence) survives if its repertoire of routines remains intact, does not survive if it suffers amnesia regarding its routines, and passes through some sort of intermediate transition when only a portion of its routines are changed (even for the better)" (1990: 280). Thus, an establishment was recorded as selected out of the unit-level population if (1) its facilities were vacant for more than two years or (2) it actively migrated out of the gasoline retail niche. The retention of annual gasoline station inspection certificates in the City of Edmonton building files greatly facilitated verification of operating status.

As we defined selection as occurring at the gas station level when an establishment exited the focal niche of gasoline retailing irrespective of its continuing viability in other pursuits, we adopted a similar approach in our consideration of selection events at the oil company level: An oil company had been "competed into failure" from the standpoint of the study population if it no longer had retail outlets within the city limits of Edmonton. Thus, for the purposes of this study, such events as the withdrawal of Chevron from the market in 1968, the failure of Anglo American Exploration (Purity 99) in 1965, and the acquisition of Gulf Oil retail outlets by Petro Canada in 1986 all represent oil company failures.

Classification at the organization level was based on the percentage of stations of each form affiliated with each oil company: To address the broader issues with which we were concerned, we limited our interest to whether an oil company had more than 50 percent of its outlets in the service station form (identified as MSS, "mostly service stations") or more than 50 percent of its outlets in alternate forms (MAF, or "mostly alternate forms," such as gas bars, car washes, and convenience stores). Transformation was deemed to occur at the point at which a firm crossed the line from MSS to MAF in terms of its outlet mix.

Controlling for changes in population size. Since the essential tension under examination in this study was that between transformation/selection and replacement, we calculated separately the amount of founding and failure required, at a minimum, to accommodate the growth and decline in the size of the overall populations of gas stations and oil companies over the 30-year period from 1959 to 1988. Accounting for these numbers separately in the analysis provided a baseline for event frequency.

Determination of baseline events at the unit level. From Figure 2, it can be seen that, although the overall size of the population of service stations did not increase or decrease dramatically, there were periods of growth and decline in the number of operating organizations. We acknowledge that change in density is a dynamic process, wherein a 100 firms could be founded and a 100 fail with no net effect on overall numbers in the population occurring; but our objective was to identify the minimum number of these events that would be necessary to create the yearly changes shown in Figure 2. These figures are 196 foundings for years of increase and 91 failures for years of decrease. The number of events that actually occurred above the minimum required for population increase and decrease—the "churning" of the population—should be of some empirical interest in its own right.

Transition event predictions: Unit level. From the raw numbers of each form at time 1 (1959) and time 2 (1988), we began to estimate the number of events that we might expect to observe over the period of the study if the population of outlets built to its 1988 state under the exclusive operation of either Darwinian or Lamarckian processes. These estimates provided the theoretical limits between which we expected to find the empirical reality.

In 1959, there were 262 service stations, 1 gas bar, 1 car wash, 0 convenience stores, and 15 mixed use locations. In 1988, there were 104 service stations, 73 gas bars, 84 car washes, 73 convenience stores, and 40 mixed use locations. How would Darwinian processes bridge these two configurations of the unit-level population? First, there would be no successful transformations. Form changes would either not be attempted or would result in failure shortly thereafter. Second, there would be 158 (262 – 104) failures of service stations overall, of which 91 could be attributed to interim periods of decline (baseline), leaving 67 for internal population reconfiguration. Third, there would be at least 72 foundings of gas bars, 83 foundings of car washes, 73 foundings of convenience stores, and 25 foundings of mixed use locations to accommodate both the 196 foundings necessary to sustain the interim periods of increase (baseline) and the 57 additional foundings required for internal changes in the composition of population forms. The allocation of interim decline to service stations and interim growth to alternate forms is arbitrary and was done to move the population in as straightforward a manner as possible from time 1 to time 2. In actual fact, service stations continued to be founded into the population in substantial numbers (although at a steadily decreasing rate), and alternate forms were not uniformly successful.

An ideal-type analysis based on Lamarckian processes might approach the 1959 and 1988 numbers in either of two ways: Since there are 262 service stations in 1959 and the total increase in alternate forms is 253, transformations could account for all additional gas bars, car washes, convenience stores, and other uses, leaving 9 service stations intact. Presumably, another 95 service stations would be founded at a minimum to bring numbers of that form up to the 1988 level of 104. This version of events places all the onus for population-level adaptive change on existing establishments and assumes that new entrants will continue to use rapidly obsolescing forms.

Using an alternate approach, we might begin by assuming that the 104 service stations in 1988 reflect choices *not* to transform with the result that only 158 (262 – 104) stations are available for transformation and a further 95 (253 – 158) gas bars, car washes, and so forth must be founded into the population. This version has fewer transformation events at the organization level but does provide for greater learning at the population level as new entrants embrace the more adaptive forms. Given the large influence of multiunit competitors in this population, we believe the transfer of learning to this level to be the more defensible alternative. If the primary decision-making nexus for outlet-level events is at an oil company's head office, it seems unrealistic in the extreme that existing outlets would be converted into the more successful forms while new outlets continued to be founded into the less-favored service station form.

It should be noted that with each approach, however, there are far fewer predicted foundings than the minimum attributable to periods of natural increase in this population (196). Each approach also has great difficulty providing for the minimum number of failures necessary to accommodate real decreases in overall population size (91). If all the service stations either persisted or changed into alternate forms, and those forms founded into the population are uniformly successful, which stations failed?

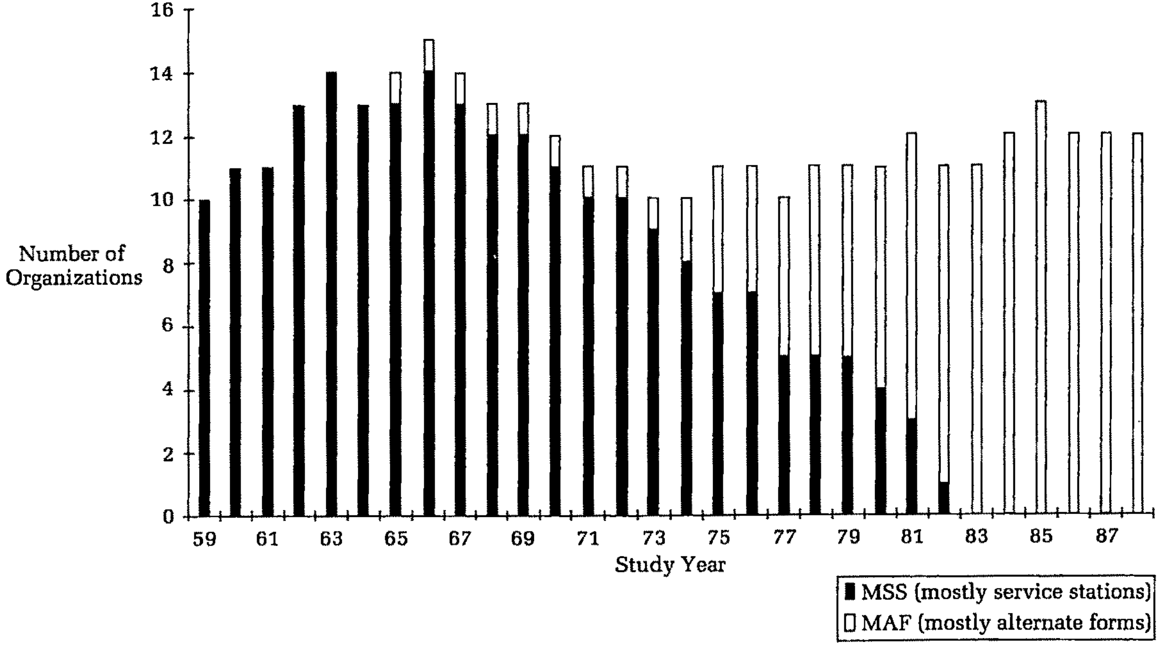
Determination of baseline events at the organization level. We used a similar approach to calculate the minimum numbers of entry and exist events necessary to accommodate periods of natural increase and decrease at the oil company level. Figure 5 provides summary information on the diversity and distribution of forms among the 25 organizations operating at this level during the 30-year period studied. Minimums of 9 foundings and 9 failures are required to account for periods of overall increase and decrease as that population moves from 10 organizations in 1959 to a high of 15 organizations in 1966 before returning with minor fluctuations to a count of 12 by the end of the study period.

Transition event predictions: Organization level. At the organization level, if only Darwinian processes are at work we would expect new oil companies to be founded into the population and would expect those that are successful to compete into failure (cause to exit from the market) some number of existing oil companies. The successful new companies will be mostly composed of outlets representing one or more of the newer forms appropriate to the emerging environment: gas bars, car washes, and convenience stores. The oil companies that exit will be mostly composed of service station outlets. We again used the raw numbers from time 1 (1959) and time 2 (1988): At time 1, there were 10 oil companies, all of which had mostly service stations (MSS) for outlets. At time 2, there were 12 oil companies, all of which had mostly alternate forms (MAF: gas bars, car washes, and convenience stores) for outlets.

If we follow the method used above, our expectations based on Darwinian processes would begin with zero successful transformations of oil companies from mostly service stations to mostly alternate forms. Second, there would be 10 (10 − 0) exits of MSS oil companies overall, of which 9 could be attributed to interim periods of decline (baseline), leaving 1 for internal population reconfiguration. Third, there would be at least 12 entries of MAF oil companies to accommodate both the 9 entries necessary to sustain the interim periods of increase (baseline) and the 3 additional entries required for internal changes in the composition of population forms.

Using an ideal-type analysis based on Lamarckian processes at the organization level to approach the transition from the 1959 to the 1988 numbers, we obtain the following: Since there are 10 MSS oil companies in 1959 and the total increase in MAF oil companies is 12, transformations can only account for 10 MSS to MAF transitions, leaving another 2 MAF oil companies to enter at minimum to bring their numbers up to the 1988 level. This version of events places all the onus for population-level adaptive change on

FIGURE 5
Change in Diversity and Distribution of Oil Company Retail Mix, Edmonton, 1959–88



existing establishments, but also implies that new entrants will adopt the more successful MAF configuration of units. As occurred with the unit-level analysis, however, there were far fewer predicted entries than the minimum attributable to periods of natural increase in this population (9). Also, as all MSS oil companies change into MAF oil companies, there is no allowance for the minimum baseline exits (9).

RESULTS

Population Reconfiguration: Unit Level

As Figure 2 illustrated, it is possible to graphically depict changes in both the diversity of forms in a population and the distribution of organizations over those forms for a given time period. Figure 2 shows how stand-alone gas bars, convenience stores with pumps, and car washes with pumps gained substantial ground over the conventional service station with its combination of gas retailing and vehicle servicing.

These results show quite clearly that there are observable changes in the population that must arise from some combination of the processes of population dynamics. An examination of the relative frequencies of the transitions identified in Figure 4 serves as a first approximation of the contributions of selection and transformation in this reconfiguration of the population. Overall, the change in this population is the result of 309 foundings, 8 migrations into the niche, 214 intraniche changes of form, 32 migrations out of the niche, and 199 failures. Table 2 breaks these numbers down for each of the forms in the population. The left side of the matrix gives the origin state for each transition and includes foundings and migrations into the population as well as the initial form for each transformation event. The top of the matrix gives the destination state for each transition and includes failures and migrations out of the population as well as the ending form for each transformation event. Figures on the diagonal of the matrix, where origin and destination states are the same, represent the total number of organization-years for each form during which no changes took place. Frequencies have been adjusted to exclude failed and right-censored transformations. A transformation was deemed to have been successful if the establishment in question was still operating three years later. Adopting this criterion, there were 8 failed transformations and 6 right-censored observations out of the total of 200. There was no apparent clustering of these exclusions with respect to particular transitions. The provision of a three-year trial period for transformations was intended to capture the possibility of influences similar to those in a study reported by Amburgey, Kelly, and Barnett (1993), who found that transformation increased an organization's short-term chance of failure. In this population, however, lagged change was not a significant predictor of failure, and time-since-last-change was positively related to failure rates (Usher, 1994), implying that *lack of change* was associated with failure among these establishments. We also calculated average event rates (Table 2) for founding, failure, and transformation using the total number of organization years or spells during which each form was at risk over the period of the study. The whole population was assumed to be at risk for founding purposes. These figures are provided for comparison with those for other study populations.

Figure 6 compares the strict Darwinian and Lamarckian boundaries with the actual number of events of each type that occurred as the unit population reconfigured. Getting from the 262 service stations and 17 non–service stations of 1959 to the 104 service stations and 270 non–service stations of 1988 required 199 failures (159 service stations, 4 gas bars, 9 car washes, 3 convenience stores, and 24 mixed uses), 309 foundings (133 service stations, 67 gas bars, 41 car washes, 42 convenience stores, and 26 mixed uses) and 144 transformations from service stations to non–service stations, of which 129 were successful. A further 56 transformations involved changes among the alternate forms, as noted in Table 2.

As we consider these findings, perhaps the most obvious result is that both Darwinian and Lamarckian processes are at work in the population-level changes taking place. Is it possible to conclude that one process has had a greater influence than the other? It might be suggested that, given the sheer volume of founding and failure events, which outweigh transformation events by nearly 3 to 1, Darwinian processes have had the greater impact here. However, this interpretation should be conditioned by two facts. First, at least 187 of the founding and failure events (more than a third) contributed to changes in the size of the population at its margins, rather than to its internal reconfiguration of forms. The same population undergoing purely internal changes might have done so with far fewer selection/replacement events. Second, it should be recognized that moving from a service station to a non–service station using selection/replacement requires that the former fail and the latter be founded—a two-event occurrence. Adaptation accomplishes the same transition with a single event. We might thus expect that, ceteris paribus, the ratio of sheer numbers of events attributable to selection/replacement and adaptation would be 2 to 1. The actual ratio of selection/replacement to adaptation in this population, after removing the events attributable to overall size change, is 321 to 185. Thus, the relative impacts of Darwinian and Lamarckian processes swing from an initial position that highly favors the former to one that slightly favors the latter but is nearly a melded balance in which the two processes have equal play.

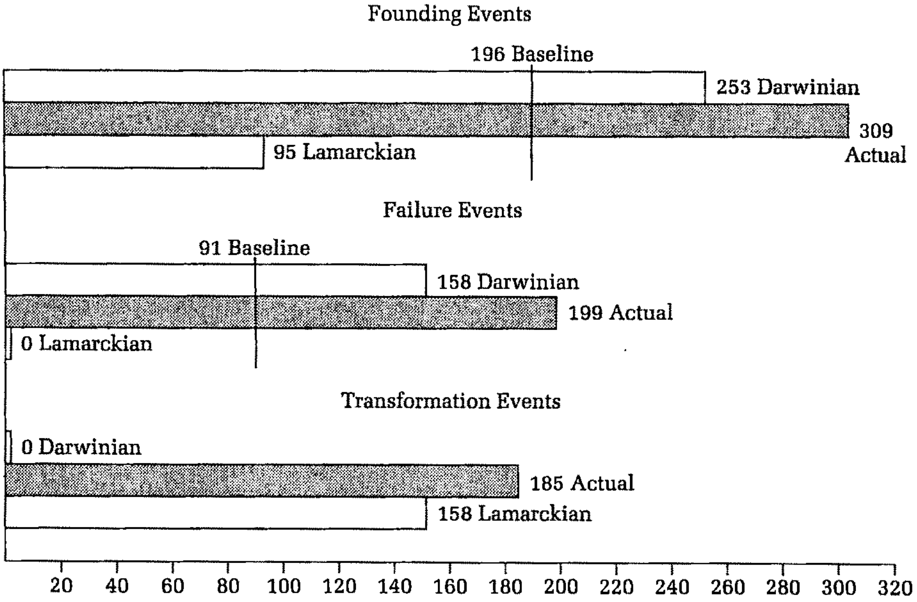
Population Reconfiguration: Organization Level

As we outlined above, the examination of Darwinian and Lamarckian processes for organizational entities involved in selling gasoline in Edmonton can be conducted at both unit (gas station) and organizational (oil company) levels. With Figure 7, we begin our presentation of results with an overview of the entry and exit of oil companies with respect to the Edmonton market. For each company we report entry and exit dates, form status (MSS

TABLE 2
Summary of Niche Transition Frequencies and Rates

Origin State	Destination State						
	Failure	Migration Out	Service Station	Gas Bar	Car Wash	Convenience Store	Other
Niche transition frequency							
Founding			133	67	41	42	26
Migration in			1	2	2	2	1
Service station	159	20	6,109	23	44	34	43
Gas bar	4	0	1	632	8	12	3
Car wash	9	1	0	4	1,128	7	0
Convenience store	3	1	2	2	0	597	1
Other	24	10	11	5	9	5	710
Niche transition rate							
Founding			0.01419	0.00715	0.00438	0.00448	0.00277
Migration in			0.00011	0.00021	0.00021	0.00021	0.00011
Service station	0.02480	0.00320		0.00328	0.00655	0.00515	0.00624
Gas bar	0.00610	0.00000	0.00152		0.01220	0.01830	0.00457
Car wash	0.00790	0.00088	0.00000	0.00176		0.00527	0.00000
Convenience store	0.00498	0.00167	0.00332	0.00332	0.00000		0.00166
Other	0.03243	0.01397	0.01216	0.00676	0.01216	0.00676	

FIGURE 6
Comparison of Process Boundaries and Actual Population Data, Unit Level



or MAF) by year, and transition points at which organizations changed from mostly service stations to mostly alternate forms.

Figure 8 compares the strict Darwinian and Lamarckian boundaries with the actual number of events of each type that occurred as the organizational population reconfigured. Getting from the 10 MSS oil companies of 1959 to the 12 MAF oil companies of 1988 required 13 exists (11 MSS, 2 MAF), 15 entries (8 MSS, 7 MAF), and 7 transformations from MSS to MAF. As at the unit level, it is clear that both processes of population change are at work here: Large numbers of firms (relative to the size of the population) entered and exited the market, accounting for a turnover in membership of more than 50 percent. Also, the fact that 7 of the 9 companies operating mostly service stations (MSS) in the early 70s successfully transformed into mostly-alternate-forms (MAF) operations shows the strong role of internal adaptation.

Population Reconfiguration: Temporal Sequencing

But although these analyses clearly demonstrate the relevance of Darwinian and Lamarckian processes at both levels studied here, we also wish to derive some understanding of the dynamic interplay of these forces. Does transformation of existing outlets follow the founding of new forms as a mechanism for form change? Or do existing outlets routinely undertake form changes and thereby provide models for both managed and entrepreneurial foundings? Would we find different answers to these questions for different

FIGURE 7
Entry, Exit, and Transformation of Oil Companies

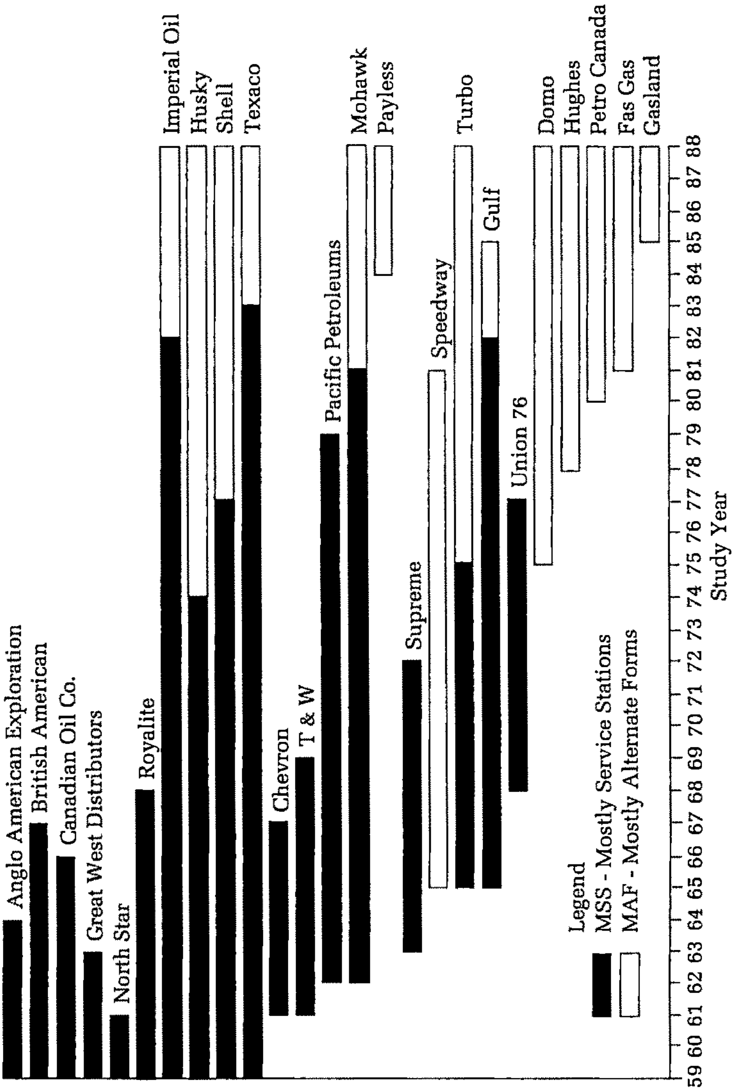
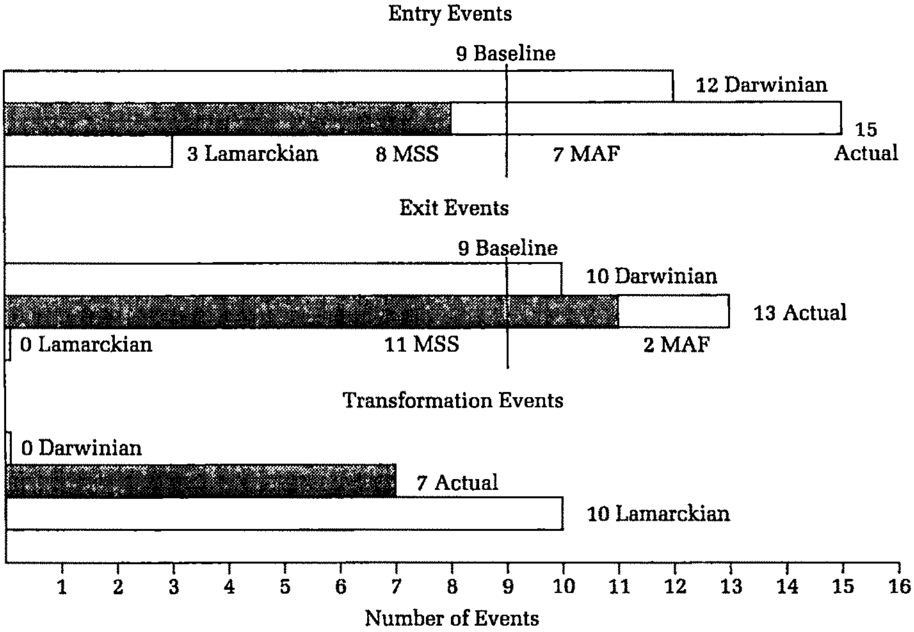


FIGURE 8
Comparison of Process Boundaries and Actual Population Data Organization Level[a]



[a] MSS = mostly service stations; MAF = mostly alternate forms.

transitions or different forms? Is there an identifiable role for variations in environmental uncertainty?

Fortunately, it is possible to approach these questions empirically by adding a further refinement to the categorization of niche transitions, the results of which appear in Figure 4. First, let intraniche change, migration out, and failure be conditioned by whether the origin state in each case is an original founded form or the result of a previous form change. Then, given that the founding form of all members of the population is known, a count can be made, in each year of the study, of the number of establishments founded into and persisting in any particular form, as well as the number of establishments that have entered that form through transformation. Figures 9 through 12 explore possible differences among the constituent forms of the population for these relative counts across the period studied.

By disaggregating the population forms in this way, it becomes possible to trace the process of reconfiguration more clearly over time. Population change in the first decade, corresponding approximately to the 1960s, is dominated by foundings and failures of conventional service stations. Beginning in the 1970s, however, and coincident with much of the environmental change reviewed above, car wash, convenience store, and stand-alone gas bar forms gain membership rapidly. Where these forms arise from

FIGURE 9
Gas Bar Foundings Versus Transformations

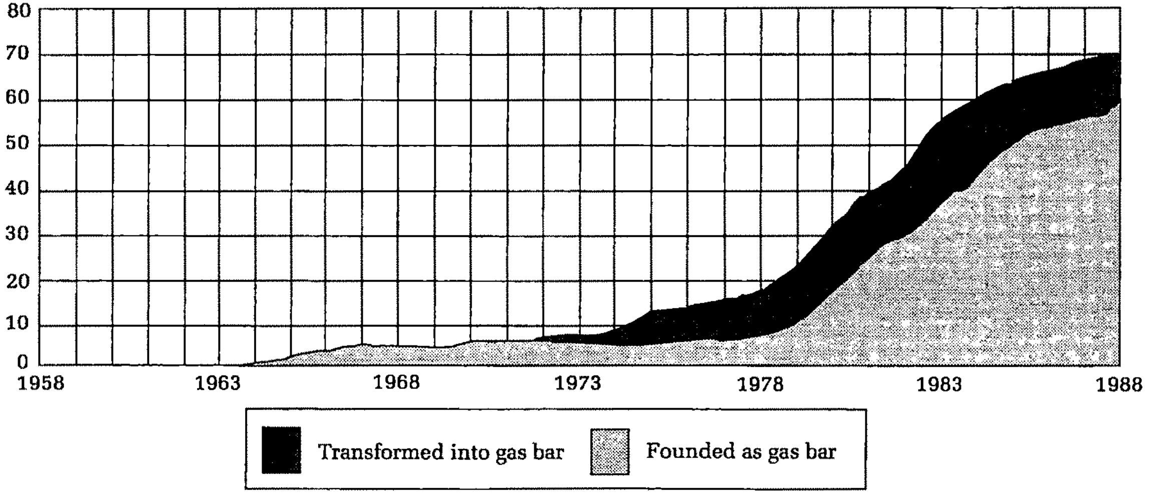


FIGURE 10
Car Wash Foundings Versus Transformations

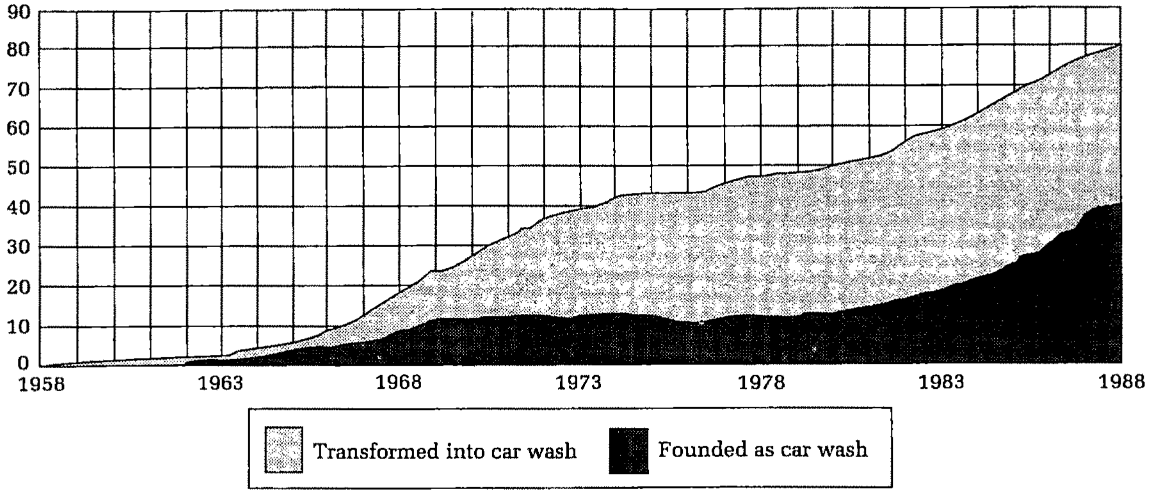
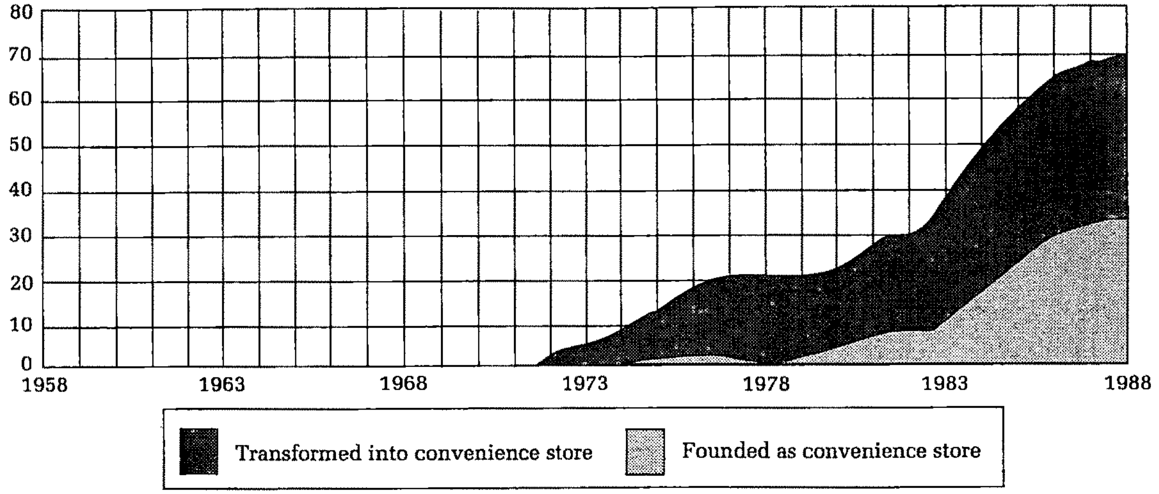


FIGURE 11
Convenience Store Foundings Versus Transformations



transformations, it is apparent (from Table 2 and Figure 12) that the service station form is the principal origin state.

It is interesting to note that each of these forms built to its present size in the overall population in slightly different fashion. Foundings clearly led transformations as a means of entering the gas bar form in its early development and continue to do so. Convenience stores, in contrast, were primarily transformations in the growth stages of the form, but foundings have occurred more recently in nearly equal numbers. The car wash form is the intermediate case, with neither force dominating initially, although across time, more establishments appear to have entered the form through transformation than through founding. We explore the implications of these findings below with special emphasis on the comparative differences between the convenience store and gas bar forms.

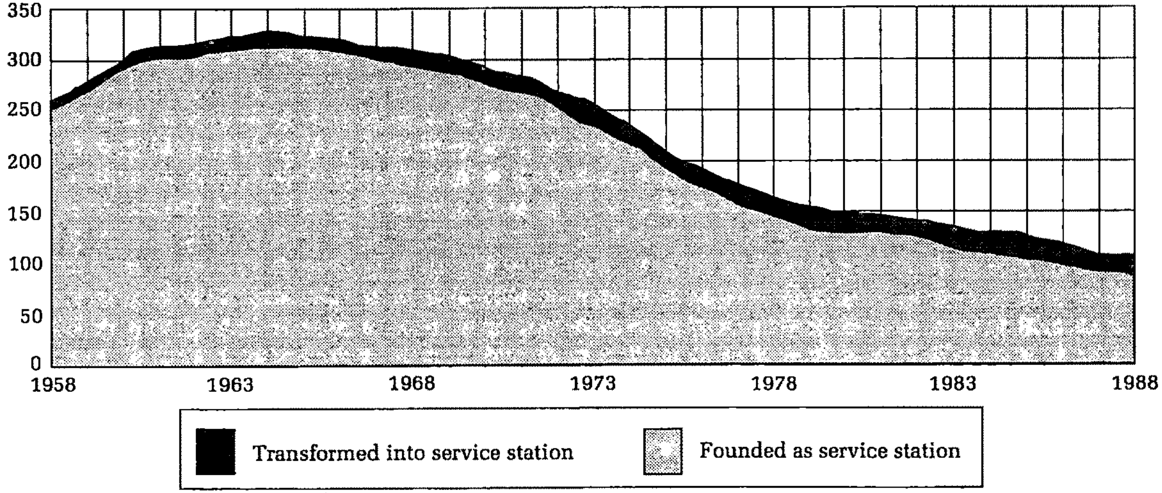
DISCUSSION

The research reported here is an attempt to close a conceptually simple, but important, gap in the empirical record that underpins academic understanding of the relationship between Darwinian and Lamarckian processes in population-level change. One question at a very basic level is if anything reported here fails to support current thinking about population-level change among organizational ecologists. As we read these results, they are a strong endorsement of the role of Darwinian processes in population-level change. Without the unique perspective that has grown out of Hannan and Freeman's (1977) insights, nearly half of the changes through which this population has been transfigured—foundings and failures—would have been seen (if they were seen at all) as isolated events disconnected from the managerial tinkering assumed to be the central dynamic of restructuring.

These results do, however, cast some doubt on the universality of statements like the following: "From a societal viewpoint, then, most organizational change occurring (at the population level) in any historical period is the result of processes of organizational selection and replacement rather than internal transformation and adaptation" (Carroll, 1988: 2). Whether we view the entities in this population at the unit level or the organizational level, it is apparent that Lamarckian processes have figured prominently in the changes that have taken place. Of course, what constitutes change and what constitutes failure in organizations at the population level can be made to serve the strong selection argument. One could argue that, with the exception of those establishments that migrated into or out of this population, little change actually took place. After all, a gas station is a gas station is a gas station. Now, if these establishments stopped pumping gas and started dispensing burgers—that would be fundamental change! But wouldn't we say that a gas station that stopped pumping gas had failed, rather than changed? If we adopt a competency-based view of failure (Winter, 1990), rather than the more standard (and empirically convenient) approach of looking for changes in legal status, then a change so fundamental that is extinguishes the

FIGURE 12

Service Station Foundings Versus Transformations



core competency of individual organizations must inevitably be seen to achieve change at the population level through Darwinian means.

However, if we accept that the form changes seen in this study are not merely cosmetic, but reflect real variations upon which Darwinian and Lamarckian processes have acted to reconfigure this population, we can begin to consider how these processes combine. We have examined how vital rates of entry, exit, and transformation have changed populations defined at the unit and organization levels. We have raised several questions that relate to the temporal sequencing of events and presented some preliminary analyses (Figures 9–12). We turn now to the discussion of these results.

It is clear from working with the data supporting Figures 9–12 that much early transformation occurred as service station operators attempted to profitably use idle repair bay space by converting it to retail space or installing car wash facilities. Some tried to sell garden supplies; others rented cars or expanded their tire sales efforts. This initial period of experimentation coincided with a time of great uncertainty as stations attempted to cope with changing customer preferences, new competitors, industry overcapacity, and new possibilities arising from legal and technological changes. A number of new competencies were introduced into the population during this period—exclusively by existing stations—but few of these adaptations produced forms that were selected for in the population. Hybrids like "gas 'n garden" just didn't catch on. However, with the adoption of self-service gasoline dispensing, yielding the presence of a full-time cashier in each outlet, the gas bar/convenience store retail form did prove to be a highly effective combination, and a large number of transformations into this form were initially retained in the population: 21 between 1972 and 1977 (Figure 11). The oil companies were not blind to the success of this form,[3] of course, and new stations were soon designed and built to maximize its inherent efficiencies: more pumps were added, and station layouts were changed to optimize entry and exit flows and thus increase throughput. Retail sales inventories were expanded to full convenience store size, with gasoline handled as just another item. In fact, these new entrants to the niche were so successful that in most cases the original transformed stations had to either undergo a complete restructuring to adopt the new form or become victims of the latest version of their own ideas.

The way in which these processes combine for the transition from service station to convenience store can be contrasted to the case of the standalone gas bar (Figure 9). Here the early history of the form is characterized by foundings. Most early gas bars took advantage of locations that were inappropriate, either by reason of space or bylaw, for the construction of a standard service station. Their existence is thus attributable to specific local conditions rather than to broader environmental influences. Transformations into gas bars were relatively late arrivals on the scene and never achieved the penetration of other forms. Comparing the chronological timing of the transformations into gas bars with those into convenience stores, however, does suggest that the same environmental forces were operative in both transitions. Many early transformations into gas bars were simply service stations that closed down their service bays and operated on gasoline retail revenues only. But this is a highly ineffective configuration, given that most standard stations are in neighborhood locations with insufficient traffic flow to justify such specialization. The relatively minor role transformations play in the growth of the gas bar form in the population shows that the oil companies saw it as a less useful model to adopt. When the gas bar "takes off" during the last decade of the study period, its success is attributable to a high-throughput design founded into the population as new locations are opened up by demand expansion.

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[3] Oil companies did not, of course, discover this form in Edmonton. Similar experiments were taking place across North America as the industry attempted to cope with the changes noted above. We note only that there were enough successful trials in Edmonton for the companies to have drawn such a conclusion.

This last point—the spatial context of competition—may prove to hold the most promise for developing greater understanding of events in this population. A preliminary analysis of event sites supports models of ecological succession (Aldrich, 1975; Park, 1936) and metropolitan decentralization (Ironside & Williams, 1980; Sly, 1982). Most service station failures in Edmonton occurred in inner-city residential areas encroached upon by the expanding central business district. Most successful transformations into convenience stores took place in established neighborhoods in which there were few competing commercial land uses. Finally, most gas bars were founded in newly developed suburban areas of the city; since there were no pre-existing service stations convenient to these locations, transformation was not a feasible option. Preliminary research in the area of spatial competition is demonstrating that this approach has special merit for studying organizations for which locational convenience is an important competitive attribute (Baum & Mezias, 1992; Baum & Haveman, 1995; Usher, 1995).

CONCLUSION

In conclusion, we offer this study as an important step forward in academic understanding of population-level change processes. We have identified and examined in detail a population that reconfigured itself from a relatively homogeneous state dominated by a single form to one characterized by several successful alternate forms. According to Hannan and Freeman, this level of analysis concerns the "demography of organizations" (1989: 14) because of its focus on the founding, merger, and disbanding rates of a single population. We are hopeful that our findings will inform the search for variations in these rates between populations and over time in such a way that basic regularities in these rates can be identified.

Our agenda takes us in a different direction, however. We prefer to consider the contribution of this research to the understanding of evolutionary dynamics in organizations (Baum & Singh, 1994). Considering the dynamics of Darwinian and Lamarckian processes at multiple levels has, we believe, made important progress toward laying to rest the perennial selection/transformation debate. Our position is consistent with that of Levinthal (1991: 144), who argued that selection and transformation are neither competing nor simply complementary processes, but fundamentally interrelated. Thus, a shift in the resource patterns that sustain a form may be associated with (1) failures of some number of representatives of that form, (2) transformations that constitute variations of the original form, and (3) foundings within the original form, its transformed variants, or new variants. In our case, selection forces initially favor the convenience store transformation, but not the gas bar. As organization designers learn the operative lessons, however, it is foundings modeled on transformed variants (in the former case) and new variants (in the latter) that enjoy increasing representation within the form.

This interpretation is consistent with that of Clemens, who argued that foundings are often based on "[t]he set of organizational models that are culturally or experientially available [and] may be thought of as an 'organizational repertoire' [where] this concept integrates the theoretical vocabulary of organization theorists sensitive to diversity of form with the cognitive or cultural framework of 'repertoires of collective action' put forward by social movement scholars attuned to historical variation (Tilly, 1978, 1986)" (Clemens, 1993: 758–759). Thus, the selection process does not merely separate winners from losers among particular organizations in a deterministic fashion; it may also be the most telling creator of exemplars for purposive replication by entrepreneurs (Krueger, 1993; Schein, 1983) or by the managers of form mix in multiunit organizations (Usher, 1996).

Of course, the success of these latter mimetic elements of this population's reconfiguration should not be seen as necessarily adaptive in any teleological way. After the turbulence of the 1970s, this industry may merely have entered a period of convergence (Tushman & Romanelli, 1985), wherein the replication or incremental adjustment of existing structures and practices yielded good returns. Any major disturbance in the relative stability of the industry could create new uncertainties, stimulating experimentation and setting up a new pattern of selection forces to pick over the latest mix of mainstream and variant forms and competencies. Once relative stability permits managers to again identify successful models from an available repertoire, however, strong cohort-level learning effects seem to occur.

Baum (1996) noted that there are too few analyses of organization-level change that take advantage of "natural experiments." McKelvey asked that researchers pay more attention to "the ecological aftermath of natural environmental shocks" (1994: 326). In this article we also follow Alexander and Amburgey (1987) in our attempt to provide a highly contextualized perspective on the population dynamics of a specific group of organizational entities. In asking very basic questions about a clearly defined, homogeneous group of organizations, we attempt to contribute to a slow accretion of research findings about various populations that may build toward meaningful middle-range theory in our field (McKelvey, 1994; McKelvey & Aldrich, 1983; Romanelli & Tushman, 1986).

Future research should develop similar findings for other industries to provide for comparisons of Darwinian and Lamarckian processes across populations. Also, further work on this population could continue to develop the implications of both temporal and spatial elements of competition and explore in more detail the interplay of adaptive forces across levels as both gas stations and oil companies strive to succeed.

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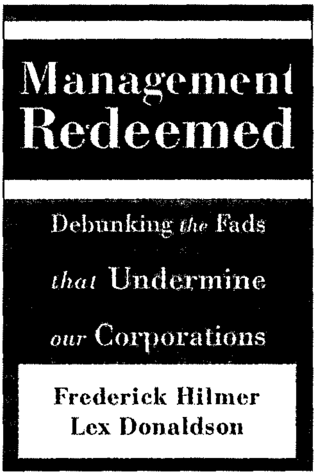

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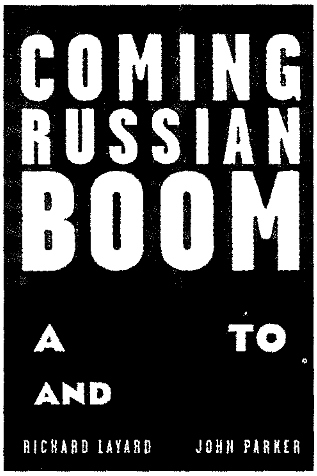

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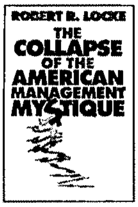

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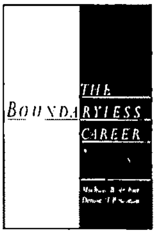

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FROM THE EDITOR

This is the final official message from me, as this issue marks the end of my three years as editor. I hope to report back, later, on a final tally of what happened to papers submitted to *AMJ* during that three-year period, but that will involve facts only. This time, instead, I would like to briefly reflect on my past three years as editor.

In the course of these years, I have been accused of various forms of personal bias, gross incompetence, and being on a power trip. Several of my colleagues in HRM and OB have suggested that I have continued past traditions and not published enough "micro" papers, and I have been accused by colleagues in other areas of favoring micro research and trying to turn *AMJ* into an IR/HR journal (I probably should be proud of the fact that both sides in this dispute were somewhat unhappy with me). Several authors have simply asserted that I was wrong in rejecting their papers, and that they would never submit to *AMJ* again. But, believe it or not, these instances have actually been few and far between. When you realize that I have received something over 1,500 new submissions during my tenure, and have reviewed another several hundred revisions, you can begin to appreciate the potential for making enemies. When you also realize that we reject somewhere around 90 percent of the papers we receive (I'll have better numbers in a few months), you might be amazed that I say that the number of real problem interactions with authors has been so small. What all of this suggests to me is that, although some of our colleagues seem to have some problems with rejection and accepting that their work may actually be less than perfect, the vast majority of our members are patient, understanding professionals, who appreciate the efforts our reviewers make to provide meaningful feedback, and who realize that not every paper is well suited for every journal. I find this rather reassuring.

I should also mention the extremely positive interactions I have had with several authors. Although we reject the majority of papers, we do occasionally accept a few. Many of these are written by scholars with some track record who, although they appreciate having their work published in *AMJ*, have become somewhat accustomed to success (although I don't know anyone who still does not get excited when a paper is accepted). But a number of papers we accept are written by younger scholars who, perhaps, have never submitted a paper to *AMJ* or a similar journal before. I have often called authors on the phone to discuss a difficult issue in the review process, and I have also tried to call authors with good news after a particularly long and difficult review process. On those occasions when I called a young scholar whose paper had made it through a tough review process, the responses I have received have more than compensated for any grumbling I have heard from other authors. In fact, the feeling that I had really done something important and helpful to someone is one I will always treasure.

Thus, the last three years have generally been quite good. I have learned much more than any Ph.D. program could give me. I have read papers in areas that never interested me before, and I have come to appreciate a wider range of research topics and strategies. I'm certain that many of you had preconcieved notions when I was named as editor about my reluctance to accept qualitative or inductive papers; and given my background and my own research, you were probably right to be concerned. I am not sure that scholars working in such areas feel that I have always done justice to their work, but I do know that I have come to a much greater understanding and appreciation of nonquantitative research and research that uses models other than the deductive models I was used to. I hope we have done justice to all of the papers I received, but I am sure that I leave this job with a broader sense of the kind of research that gets done in management than I ever had before.

In closing, then, I really want to thank everyone for allowing me to serve these three years as *AMJ* editor. Although there was a lot of hard work (and as a result, I never felt really "powerful," but I did often feel overwhelmed), I feel I gained more than I gave, and so I am truly thankful for having this opportunity. Of course, I wouldn't be totally honest if I didn't I admit that I look forward to writing and reading my own work instead of someone else's. Which reminds me of the insights provided by both Rick Mowday and Mike Hitt when I took this job. As I look back on the past three years, I can understand their comments and their feelings. It was a great job while it lasted, but I'm glad it's over. I suppose this means that the best job is that of *former* editor of *AMJ*.

Angelo DeNisi

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PUNISHMENT FROM THE MANAGER'S PERSPECTIVE: A GROUNDED INVESTIGATION AND INDUCTIVE MODEL

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We employed a qualitative interview technique to develop an inductive model of punishment from a managerial perspective. Findings suggest that managers feel pressure from a variety of sources—organizations, work groups, punished subordinates, and themselves. Managers are also aware that punishment is a highly charged cognitive and emotional event with broad and far-reaching effects that range well beyond punished subordinates and simply changing their attitudes and behaviors.

Despite scholarly advice to avoid punishment, virtually all managers find themselves delivering oral reprimands to subordinates and occasionally having to suspend or even fire an employee. Yet, except for a small amount of research regarding how managers perceive these highly charged events (e.g., Ball & Sims, 1991; Ball & Trevino, 1990; Fandt, Labig, & Urich, 1990; Mitchell, Green, & Wood, 1981), little is known about what managers actually think and feel about punishing their subordinates. In the research described here, we used qualitative methods to probe how managers actually think and feel about real punishment episodes.

THEORETICAL BACKGROUND

Punishment has been defined as a superior's application of a negative consequence or the removal of a positive consequence following a subordinate's undesirable behavior, with the intention of decreasing the frequency of that behavior. Organizational punishment research has generally been guided by this definition, reflecting the prevailing view that the goal of punishing is to modify the subordinate's undesirable behaviors. Thus, pre-

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We would like to thank Henry P. Sims, Jr., for his creative suggestions regarding the research methodology, and Daniel Brass, Martin Kilduff, and the anonymous reviewers for their helpful comments on previous versions of the article.

vious organizational punishment literature (as reviewed in Arvey and Ivancevich [1980] and Arvey and Jones [1985]) has been subordinate-centered, focusing primarily on the effects of punishment on specific subordinate behaviors, such as theft, absenteeism, and performance, or on procedures (e.g., timing, privacy) that influence punishment's effectiveness. This literature indicated that although punishment may provide short-term benefits, such as temporary subordinate compliance, it can foster negative behaviors and attitudes, including resentment, hostility, and even sabotage, over the long run. Accordingly, the subordinate-centered literature has suggested that truly effective punishment may not be possible and that managers should therefore try to avoid punishing their subordinates (e.g., Sims, 1980). Management textbooks reflect this view. Some barely address punishment or discipline at all (e.g., Daft, 1994; Griffin, 1993), indirectly suggesting that discipline is not an essential part of the managerial role. Others acknowledge that punishment is sometimes necessary and provide advice about what to do to reduce undesirable side effects (e.g., follow company policies, be consistent and moderate, be timely, punish in private), but they fail to address what the punishment process is like for managers and what their reactions to it might be (e.g., Bartol & Martin, 1994).

Researchers have begun to expand the scope of this literature in several ways. First, investigators have suggested expanding the focus beyond the punished subordinate to include other organizational members. Arvey and Jones (1985) proposed that researchers should consider punishment's indirect and social learning effects. Trevino (1992) provided a conceptual framework for studying these social effects. She argued that observers (organizational members beyond the manager-subordinate dyad who are aware of a particular punishment event) may experience a broad range of reactions. These include emotional reactions, such as feelings of pleasure when justice has been served or anger when justice has not been served and cognitive reactions, including justice evaluations and attitudinal responses like commitment, loyalty, satisfaction, and trust. The nature of observers' reactions depends upon their understanding, expectations, attributions, and evaluations of an incident. Trevino further suggested that managers should consider observers' reactions important—perhaps even more important than the punished subordinate's reaction to the discipline. Some empirical research has investigated observers' reactions to punishment (O'Reilly & Puffer, 1989; Schnake, 1986, 1987). However, researchers know little about whether managers are aware of these reactions and whether they take them into account in disciplinary situations.

Another extension has involved moving beyond content research to an emphasis on underlying psychological and social psychological processes, including attributions (e.g., Gioia & Sims, 1986; Mitchell et al., 1981), justice evaluations and punishment expectancies (Ball, Trevino, & Sims, 1994; Trevino, 1992), and cognitive and affective mechanisms (e.g., Ball & Sims, 1991). Ball and Sims (1991) used a schematic information-processing perspective to emphasize the role of emotion in punishment situations, arguing that explicit consideration of their own and others' emotions can help managers punish more effectively. Much of this work on psychological and social psychological processes has focused on punished subordinates, observers, or both. Further empirical work is needed to understand managers' cognitive and affective processes in punishment situations and the effects of those situations on managers.

A third stream of research has more directly considered managers in relation to punishment. Theoretical work within this manager-centered stream includes Podsakoff's (1982) treatment of the variables that can affect managers' use of rewards and punishments. According to Podsakoff, these can be divided into three categories: contextual variables (e.g., task structure, organizational policy), subordinate characteristics (e.g., performance, likableness), and supervisor characteristics (e.g., personality, attributions). Yet few empirical manager-centered studies have been conducted. Three exceptions bear mention. First, Mitchell and coauthors (1981) offered and tested an attributional model of how managers respond to subordinates who are performing poorly, suggesting that at least two factors (a subordinate's work history and the seriousness of the subordinate's performance failure) influence managers' attributions and punitive responses. Second, Fairhurst, Green, and Snavely's (1985) qualitative study indicated that when subordinate performance declines to a sufficiently low level, "breakpoints" in the ongoing manager-subordinate relationship are likely to occur, points at which managers intervene and take corrective actions (if a problem can be corrected). Fairhurst and colleagues' research also suggested that managers' disciplinary actions are outcomes of an active, complex "sense-making" process that allows managers to cope with and understand changes and discrepancies in subordinate performance. Third, Fandt and colleagues' (1990) laboratory experiment suggested that managers may differentially punish subordinates depending on the amount of available evidence and the degree to which the managers like the subordinates.

In sum, theorists have begun to broaden their focus and to consider the perspective of manager as well as those of observers and punished subordinates. A small number of empirical studies have extended understanding of punishment from a managerial perspective. However, these studies have focused primarily on when and why managers punish subordinates rather than on broader questions of how managers think and feel about punishment situations. Thus, the manager's perspective on punishment remains a largely uncharted territory. We hoped to contribute to knowledge about this important and inevitable aspect of the managerial role through systematic analysis of qualitative interview data grounded in managers' punishment experiences.

In this research, we had several broad goals. In general, we wanted to gain insight into what managers think and how they feel about their punishment experiences. We wanted to know whether they can easily talk about punishment incidents, whether they can differentiate between effective and ineffective incidents, and if so, how they distinguish between them.

METHODS

We employed a qualitative interview approach to gathering and analyzing managers' retrospective accounts regarding two incidents in which they had punished subordinates. Each manager identified one incident as having been effective—as having led to the results the manager desired—and the other as ineffective: as not having yielded the desired results. From these data, grounded in managers' actual experiences, new insights emerged regarding punishment from a manager's point of view.

Sample and Data Collection

This study employed a convenience sample of 77 managers, each representing a different work organization. The organizations ranged from small ones, such as a local movie theater, to large ones, such as the United States Army. The average age of managers was 38.7 years (range: 22 to 63); individuals had an average of 17.3 years of work experience (range: 2 to 40) and an average of 12.4 years of managerial experience (range: 0.5 to 29), and they currently supervised 25.2 subordinates (range: 2 to 141).

The managers interviewed for the study were contacted through students in three sections of an upper-division organizational behavior course at a major university. One of the researchers gave 120 students an assignment to conduct a structured interview with a manager of their choice on the topic of punishment, which had been studied in the course. The only requirement was that the interviewee had to have supervisory responsibilities. We gave students who wished to apply for extra credit (77 students) special training in the use of the interview protocol and in interview techniques. They were required to audiotape the interviews and to give us the tapes. The students received the extra credit if we determined from the tapes that they had followed the interview protocol accurately. Seventy-six of the audiotapes were used as data in the research. The remaining interview was unusable because the interviewer did not follow the established protocol.

Prior to designing the final interview protocol that the students used (see the Appendix), we conducted pilot interviews to determine whether managers would have difficulty recalling incidents, whether they could differentiate between incidents that were "positive" and those that were "negative" (these were the terms originally used), and whether they could answer the interview protocol questions. The protocol was refined and revised as a result. The major finding from the pilot was that managers had difficulty talking about punishment as a positive experience. However, they were quite willing and able to talk about punishment that was "effective" or "ineffective." Managers were also more comfortable with the word "discipline" than the word "punishment." These findings led to the interview protocol design in which managers were asked to choose two disciplinary incidents to discuss, one effective and one ineffective. For the purpose of this research, an effective incident was defined for interviewees as one in which "the desired outcome of the discipline was achieved." An ineffective incident was defined as one in which "the desired outcome was not achieved."

The interview protocol was designed in such a way that the interviewees were encouraged to first talk about issues that they thought were important under very general categories (e.g., "Tell me what happened . . . how was the discipline carried out?") These questions created conditions that allowed managers to spontaneously discuss topics that were important to them. Then, if an interviewee did not mention something that we thought was important in light of past theorizing and research, a more specific question was asked (by us in the case of the pilot interviews and by the students in the case of the interviews gathered for data). For example, questions such as "who knew about [the discipline]" and "was [the discipline] fair" gave us the opportunity to collect data that could support previous theorizing about the role of observers and whether justice and fairness were salient issues to managers. We hoped that this approach would allow us to provide support for past theorizing and research and also allow new issues to emerge. Glaser and Strauss's (1967) description of grounded theory development emphasizes such an interplay of experience, induction, and deduction.

Data Analyses

Content analysis. The tapes were transcribed in the college's research support center. We then analyzed them in a three-phase content analysis procedure (e.g., Glaser & Strauss, 1967; Miels & Huberman, 1984). First, in the unitizing phase, one of us broke the transcripts down into "thought units" (e.g., Gioia & Sims, 1986), each of which was then recorded on an index card. On the back of each card, notes were made regarding the interview number and whether the thought unit came from an effective or ineffective incident. Thought units ranged from a phrase, through a complete sentence, to several sentences. The goal was to capture a complete thought or idea. We recorded virtually every thought unit that pertained to the questions on the punishment protocol (see the Appendix) or that had anything to do with punishment or the punishment incident. The only material excluded was what could be called side tracks, or material that had nothing to do with the interview topic, such as discussion of the weather. Therefore, virtually everything managers said about punishment or the punishment incident was used as the basis for this step.

Second, in the categorizing phase, all of the thought units (the index cards) were organized into emergent categories by two of the three members of the research team. This was the most inductive phase of the analysis. As much as possible, we let the data speak for themselves and allowed the categories to emerge from the data. The goal was to minimize differences between thought units within a category and maximize differences between thought units in different categories. In practical terms, this meant that we created stacks of similar index cards. The thought units within a stack were thought to hang together in a single category. We then assigned labels to each category in an attempt to capture the shared message of the thought units within it and to allow additional researchers to consistently place a particular thought unit in the category. Disagreements among us regarding the categories (and their labels) were resolved through an ongoing intersubjective process involving checking to ensure that the categories corresponded to the data, negotiation, and reformulation. Because we believed this phase of the analysis to be the most important to the development of our model, and perhaps the most subject to bias, we conducted a check for the reliability of the categorization and labeling process. Two additional researchers (the third member of the team and a "blind" research assistant who was not familiar with the punishment literature) were given the list of category names and a representative subsample (20%) of the thought units (on index cards) to sort into the labeled categories. We computed interrater agreement using the relatively conservative *P*-statistic (e.g., Light, 1971). This technique involves dividing the total number of index cards for which all three raters agreed by the total number of cards, resulting in an overall interrater agreement of .81. This relatively high interrater agreement suggests that the emergent categories fit the data.

Third, in the classifying phase, the categories were grouped into seven unifying themes by two of the three members of the research team. This step was a bit more arbitrary because some categories can fit under more than one theme. We resolved disagreements regarding the themes and their labels in an intersubjective process similar to that used for categories and described above.

McNemar test. The McNemar test for related samples is the proper test for analyzing frequency data from two related (i.e., nonindependent) samples (Daniel, 1990). Thus, because managers discussed both effective and ineffective incidents, we used the McNemar test and the chi-square statistic to determine whether the same proportion of managers made statements representing a given category when describing ineffective and effective incidents.

Limitations of the Methods

Although researchers have debated the advantages and disadvantages of the critical incident method (e.g., Kerr, Harlan, & Stodgill, 1974), the popularity of this and other qualitative methods has continued to increase (e.g., Miles & Huberman, 1984). Nevertheless, researchers must be aware of the methodology's limitations. One might argue, for example, that phenomena like imperfect recall and attributional biases may compromise the accuracy of managers' retrospective accounts and perceptions of their punishment experiences. However, such distortions are of central interest to this research; our objective was not necessarily to measure the reality of punishment situations. Rather, our objective was to obtain a better understanding of how managers actually think and feel about these situations. Thus, we were at least as interested in learning about the managers' perceptions as we were in learning about the reality of punishment incidents.

One might also argue that, because the same managers discussed both effective and ineffective incidents, the data are subject to self-serving bias and contrast effects. We attempted to minimize bias in a number of ways. First, we were concerned that managers would present only effective incidents if we asked them to choose only one incident to discuss. Therefore, we hoped to reduce this type of bias by having each interviewee discuss both an effective and an ineffective incident. The contrasts between the two that they saw represented important data that we used in the research. We may not have captured the worst punishment incidents or ones that subjects were ashamed of, but we were able to capture a wide range of incidents that interviewees viewed as having gone well or not well. In fact, managers discussed a wide range of punishments, including 62 verbal reprimands, 47 firings, 15 written reprimands, 15 suspensions, and a number of other miscellaneous punishments, including probation, docking pay or benefits, demotions or stripping authority, adding extra work, and court martial.

Additionally, one might argue that critical incident research is prone to researcher bias. However, we attempted to limit such bias through use of standard techniques such as having multiple raters, calculating interrater reliabilities, and negotiating differences among the three researchers.

It is also noteworthy that the accuracy of managers' accounts may be compromised over time. Gioia and Manz (1985) argued that vicarious learning plays an important role in the development of managers' scripts (knowledge structures held in memory that specify behavior or event sequences that are appropriate for specific situations [Gioia & Poole, 1984: 449]). Thus, managers' scripts regarding punishment events evolve over time. As a result, it is virtually impossible to determine whether a manager's retrospective account of a given punishment incident accurately represents the event or is more reflective of general scripts the manager has developed about punishment incidents (e.g., Martin, Feldman, Hatch, & Sitkin, 1983). Therefore, the emergent categories may indicate "collective scripts" more than managers' unique punishment experiences. If so, we are quite interested in understanding these scripts because they are very much a part of how managers make sense of their punishment experiences.

Further, a limitation specific to this research should be noted. The fact that the interviews were conducted by students raises the risk that data collection techniques were not applied properly. However, we believe that this risk was minimized by thorough training and orientation. Also, the audiotapes provided the opportunity for us to evaluate the quality of the interviews and to eliminate any that were substandard.

The critical incident methodology also has advantages. As a number of researchers (e.g., Martin et al., 1983, Mitroff & Kilman, 1975) have noted, allowing managers to tell "stories" about their experiences allows responses to be relatively unconstrained, compared to those obtained with quantitative research techniques. Thus, critical incident techniques offer a vehicle by which rich meanings and interpretations can be conveyed from managers to researchers.

FINDINGS AND CONTRIBUTIONS

How Managers Think and Feel about Punishment: Themes and Categories

The key question driving this research was, How do managers think and feel about punishment? Analysis of the interviews yielded 48 categories that we organized into seven major themes: (1) instrumental nature of punishment, (2) impression management, (3) attributions, (4) awareness of and concern for other employees, (5) awareness of and concern for the subordinates, (6) fairness concerns, and (7) emotions. Our discussion of the themes and categories is designed to highlight major findings, support for existing theory, and, most important, contributions that go beyond existing theory and research.

Table 1 includes theme names, category names, frequencies (the number of times each category appeared in the data), and examples of each category. Although many of the emergent categories are consistent with previous theoretical or empirical research, many were unanticipated. Thus, this research contributes to a manager-centered perspective on punishment in two ways: the anticipated categories provide empirical support (often the first such support) for previous theorizing, whereas the unanticipated categories uncover new knowledge regarding how managers think and feel about punishment. Table 1 illustrates the extent to which the data either support existing theory and research or make new contributions. The reader is encouraged to use Table 1 as a guide to the discussion that follows.

The instrumental nature of punishment. The instrumental theme contains the highest frequency of responses overall, suggesting that managers think about punishment quite instrumentally. We define instrumental as "serving as a means to some end." These managers were concerned about whether the punishment worked or did not work and about positive or negative effects on themselves, the employees involved, and their work groups and organizations.

The first set of instrumental categories (categories 1–5) support a traditional view of punishment—as instrumental for changing a subordinate's attitudes and behavior. Statements demonstrating this theme include the following

> A great improvement in his attendance record. . . .
>
> It turned out well. She was later promoted into a more responsible position.
>
> His sales have shot up considerably because of discipline.

However, at least three unanticipated categories (categories 6–8) suggest that managers view punishment incidents as instrumental in ways that ex-

TABLE 1
Themes and Categories Derived from Interviews

Theme and Category[a]	Example	Research Supported/New Contribution
Instrumental nature of punishment		
1. Positive outcomes/punishment worked (202)	From my perspective, it turned out to be a positive experience . . . As a result, I feel that I have a better employee than I had before.	Support: Categories 1–5 confirm previous research suggesting punishment can be instrumental in improving subordinates' behavior and attitudes (e.g., Arvey & Jones, 1985, Arvey & Ivancevich, 1980).
2. General positive outcomes (128)	Through discipline [he] turned out to be an excellent employee.	
3. Negative outcomes/punishment didn't work (48)	She did not respond to the reprimand. Even after pointing out that [the undesirable behavior] affected her job performance and interrupted the office, the tardiness still continued.	
4. General negative outcomes (105)	She was spiteful, insubordinate . . . so this definitely had a negative outcome to it.	
5. Mixed outcomes (positive and negative) (39)	Although we hate to lose people, it was a gain for us.	
6. Manager's desire for respect from subordinate/others (32)	I think they probably gained a new ounce of respect for me, I guess, as their leader. [The subordinate] gained a lot of respect for me . . . from that disciplinary action.	Contribution: Categories 6–8 suggest that managers also view punishment as instrumental in maintaining respect and promoting organizational and vicarious learning.
7. Manager's concern for/recognition of vicarious effects on co-workers (139)	People know they can't get away with anything like that in the future. If he was not fired, the employees would see that the management was [lackadaisical].	
8. Positive outcomes for manager/organization (20)	I think it was a good learning experience for myself and all the managers.	

TABLE 1 (continued)

Theme and Category[a]	Example	Research Supported/New Contribution
Impression management		
9. Manager's implicit theories/advice regarding management/punishment (67)	Positive reinforcement is probably more important than negative.	Support: Greenberg (1990) and Tedeschi suggested that managers are likely to engage in impression management tactics when punishing subordinates. Categories 9–14 correspond to these tactics: justifications, excuses, entitlings, and enhancements.
10. Manager did his/her part, employee didn't respond/do his/her part (117)	The associate had every opportunity to correct her problem. She received several warnings and unfortunately she didn't heed any of the warnings.	
11. Manager justifications for/reasons for punishing (79)	We decided to proceed with disciplining for a number of reasons. First of all, it was an offense by the individual. We do not want to condone anything like that in the office or the workplace. Second of all, it's the law.	
12. Manager's role responsibility (67)	I did not want to do what I had to do, but I did my job.	
13. Manager searched for more information (24)	I tried to find out if there were any extenuating circumstances that might have been involved.	
14. Manager/management made no mistake/handled situation properly (68)	I think that it was handled exactly the way it should have been handled.	
15. Manager/organization made a mistake (81)	I feel that I could have been a lot harder than I was, but I think, you know, no one is perfect, we all make mistakes.	Contribution: Categories 15 and 16 extend Greenberg's (1990) thesis. These categories suggest that managers are willing to acknowledge their past mistakes and desire to learn from these mistakes.
16. Situation should never have happened/could have been avoided (34)	We called her into the office . . . drew up a document and had her sign it. This was ridiculous. It never should have happened in the first place.	

TABLE 1 (continued)

Theme and Category[a]	Example	Research Supported/New Contribution
Attributions		
17. Manager's understanding based upon internal attributions (174)	She's just that type of person. She's against authority. She has a problem with authority figures and she has a problem with anybody telling her what to do. So, it's more of a personal problem she has.	Partial Support/Contribution: Mitchell et al. (1981) demonstrated that managers form attributions regarding their subordinates' poor performance. Categories 17 and 18 extend this research to punishment contexts, indicating that managers frequently make such attributions in justifying their use of punishment and most frequently make internal attributions.
18. Manager's understanding based upon external attributions (39)	She was in the middle of a divorce with a child in a day center. She couldn't do all those things and be at work on time.	
Awareness of/concern for subordinate		
19. Miscellaneous subordinate reactions (121)	This person actually came back the next day and apologized for not doing his job.	Support: Previous research (e.g., Arvey & Ivancevich, 1980; Mitchell et al., 1981; Greenberg, 1987; Ball & Trevino; 1990) has suggested that, when punishing subordinates, managers may consider the subordinates' reactions (e.g., justice reactions) and their past relationships with the subordinates. Categories 19–21 support this claim.
20. Knowledge of subordinate's justice/injustice reactions (23)	At that time, he felt that he had really been treated unfairly.	
21. Positive history (47)	I had no idea what was happening because this gentleman had up to that time been a very reliable employee.	
22. Subordinate expected punishment (27)	When I approached him and told him what was going on, he said he knew it was coming.	Contribution: Categories 22–24 show that managers consider more than previous research suggests. Managers also consider the subordinates' expectations, whether or not the subordinates accepted responsibility for their behavior, and whether or not the subordinates accepted the discipline. Categories 25 and 26 indicate that managers seek to avoid punishment whenever possible, and that managers are generally concerned about subordinates and their livelihoods and families.
23. Subordinate accepted responsibility for wrongdoing (41)	After the confrontation, he realized that the problem was him, not the system . . . he said that he would correct it himself.	
24. Subordinate did not accept discipline/responsibility (38)	The individual felt that this was totally wrong because he didn't feel that it was his responsibility.	
25. Manager's interest in/concern for person/family/livelihood (58)	You are concerned and you always keep in the back of your mind that this is his livelihood.	
26. Manager's reluctance to punish (63)	Nobody really likes to discipline anybody. It's the most difficult thing to do.	

TABLE 1 (continued)

Theme and Category[a]	Example	Research Supported/New Contribution
Awareness of/concern for co-workers/others		
27. Co-workers'/others' nonemotional reactions to punishment (44)	The co-workers and the other union people felt the company was correct in taking the action.	Support: Trevino (1992) argued that managers should be aware of others' cognitive expectations, cognitive reactions (e.g., justice evaluations), and emotional reactions. Categories 7 and 27–30 provide empirical support for this theory.
28. Co-workers'/others' knowledge of/reaction to misconduct (51)	A lot of people felt that he should have been fired immediately.	
29. Co-workers/others' knowledge of/expectations of punishment (25)	As far was what other people thought . . . I think they probably thought I would really chew him out good.	
30. Knowledge of others/co-workers' justice/injustice reactions (40)	The others felt that it was a fair decision and that their well-being was looked out for.	
31. Manager's concern for organization (finance, morale, customers, etc.) (92)	It is important to think about the repercussions like the morale of the employees.	Contribution: Category 31 suggests that, in addition to having an awareness of observers, managers also have larger concerns regarding the entire organization (e.g., morale) and outside interests (e.g., customers).
Fairness concerns		
32. Concern for punishment contingency (71)	I put it in writing . . . if she kept up this attitude, if she kept doing the things that she'd been doing wrong, she was going to be terminated.	Support: Previous subordinate-centered research suggests that managers should punish contingently, constructively, with appropriate severity, privately, consistently, and in a timely fashion. Categories 32–37 confirm that managers do consider these factors, although some categories (e.g., contingency) clearly were more prevalent than others (e.g., equity, timeliness).
33. Concern for constructiveness (65)	I have spent time with him, showing him how he can do his job better with less aggravation.	
34. Concern about punishment severity (31)	I believe the oral reprimand was correct based on the severity of the offense.	
	Some people, you can merely counsel them and they will see the error of their ways. Others, you have to use more harsh punishment to get their attention.	

TABLE 1 (continued)

Theme and Category[a]	Example	Research Supported/New Contribution
35. Concern for privacy (61)	I handled it privately. I did not feel that it was something that needed (to be) broadcast to the other employees.	
36. Concern for equity/consistency (13)	It was fair. The other employees would get the same discipline.	
37. Concern for timing/timeliness (7)	The disciplinary action was taken immediately after the incident happened, which is very important.	
38. Concern about punishment procedures (199)	According to the union, they have to have a union representative with me when I discipline, whether it be verbal or other.	Contribution: Category 38 (along with categories 32–37) suggests that managers are significantly more concerned about procedural justice issues (e.g., using standard procedures) than distributive justice issues (equity, severity) when considering their punishment incidents. Category 39 suggests that managers also consider flexibility important when punishing their subordinates.
39. Punishment should be flexible (39)	They don't deserve the same punishment, even if they did the same crime.	
Emotions		
40. Manager's negative emotions (203)	I was very fidgety and very nervous and scared for her and embarrassed for her because I know that that is probably the worst conversation anyone can have with you.	Support: Categories 40–44 support previous work (e.g., Ball & Sims, 1991; Ball & Trevino, 1990; Trevino, 1992) which has suggested that the manager, the subordinate, and observers are likely to experience a variety of (primarily negative) emotions when punishing their subordinates.
41. Manager's positive and/or nonnegative affect (41)	I did not feel guilty anymore. When it was done, I felt terrific.	
42. Manager's general or mixed emotions (24)	I had mixed emotions. I was pleased and I was displeased at the same time.	

TABLE 1 (continued)

Theme and Category[a]	Example	Research Supported/New Contribution
43. Others'/co-workers' emotional reactions (71)	The other people in the class were initially very shocked.	
44. Subordinate's negative emotional reactions (98)	Since the employee was denying the charges . . . it made it very difficult, very embarrassing, and very unpleasant for the employee.	
45. Subordinate's positive and/or nonnegative affect (32)	He was pretty understanding. He did not have any hard feelings.	Contribution: Categories 45 and 46 suggest that managers perceive that their punished subordinates experience positive as well as negative emotions. Category 47 indicates that managers believe that certain punishment situations require that they conceal their emotions. Category 48 suggests that managers perceive that punishment situations create an inherently emotional "atmosphere."
46. Subordinate's mixed feelings/general feelings (8)	He was upset at first, but now he realizes that it was good. It has helped him.	
47. Manager's lack of feelings (20)	I approached it in that manner without any real emotions one way or the other. I was very hot, but did not let it show.	
48. Punishment atmosphere as emotional/tense (23)	It was a very emotional issue and touched a lot of people. There's always emotion when you discipline someone.	

[a] Figures in parentheses are frequencies, the total number of times a category appeared in the data.

tend beyond modifying punished subordinates' attitudes and behavior. In fact, their thoughts reach far beyond the subordinates to the instrumental impact on the managers (respect earned), other workers (vicarious learning accomplished), and the organization as a whole (organizational learning accomplished).

The largest of these categories was "manager's concern for/recognition of vicarious effects on co-workers," for which there were 139 representative statements. Many managers view punishment as an opportunity to promote vicarious learning (Bandura, 1977) by delivering a message to all of their subordinates that certain types of misconduct will not be tolerated. These vicarious effects of punishment incidents were recognized as important whether the managers decided to discipline or not. In the words of one interviewee, when discipline was imposed, other workers learned that "they can't get away with anything like that in the future" (category 6). Alternately, another manager said "If he was not fired, the employees would see that the management was lackadaisical" (category 7). Statements of both types show that managers are quite aware of the indirect learning effects of their punishment decisions.

Second, managers made statements regarding maintaining or increasing respect from subordinates and other employees (category 6). Punishment served to enhance perceptions of the managers as good and competent and improved working relations. As one manager said

> This was one of the few, if only, incidents that I ever knew about where somebody was let go and I was the one to do it. . . . I think I gained the respect of a lot of people a lot more quickly than I would have just showing how good a manager I [am] in other ways. So I think it was good, I had other people responding . . . in time they knew I did the right thing . . . and I think they respected me and worked with me better afterwards.

Finally, managers said that they, their organizations, or both learned from the incidents (category 8): "I think it was a good learning experience for myself and all the managers." This finding represents an important subtheme embedded in the more general instrumental theme. This subtheme relates to the impact of punishment incidents on learning for the focal managers and subordinates, other subordinates, and the organizations. When something goes wrong (e.g., a rule is broken, a standard is not met) a manager has an opportunity to respond. Whether the response involves punishment or not, a number of people can learn from the incident, including the manager. Given the recent emphasis in the management literature on organizational learning, researchers may want to consider the role of discipline in the organizational learning process. It is important to note that this learning subtheme extends well beyond the narrower type of learning discussed in the conventional organizational behavior modification literature (e.g., Luthans & Kreitner, 1985).

In sum, these findings suggest that managers view punishment incidents as instrumental in achieving a broader set of objectives—respect, vicarious learning, and personal learning—than previous research has suggested. Although it is unclear whether managers intended to obtain these outcomes in advance or perceived them as post hoc benefits, managers clearly view punishment as instrumental in obtaining a variety of desirable outcomes beyond changing an individual subordinate's attitudes or behaviors.

Impression management. Schlenker defined impression management as "the conscious or unconscious attempt to control images that are projected in social interactions" (1980: 6). We have labeled the second theme "impression management" because the categories under this theme represent managers' attempts to present a positive image to the interviewers—to demonstrate that they were doing what had to be done, knew what they were doing, and were justified in doing it. According to Leary and Kowalski's (1990) summary, (for additional reviews, see Baumeister [1982], Schlenker [1980], and Tedeschi [1981]), impression management theorists maintain that organization members are "intuitive politicians" (Tetlock, 1985: 204), attempting to create an impression for both themselves and others that their intentions, decisions, and actions are fair, consistent, reasonable and legitimate (e.g., Greenberg, 1990). Researchers have yet to examine impression management as it relates to organizational punishment, despite the fact that punishment events provide fertile ground for the use of impression management tactics. This research provides the first empirical evidence in this area.

Schlenker and Weigold (1992) explored how people attempt to explain or account for events that challenge their desired social identities. When confronted by such a challenge, people often deal with it by constructing self-serving explanations (e.g., Tedeschi & Reiss, 1981), such as making excuses, offering justifications, and offering apologies (Schlenker & Wiegold, 1992). In addition, theorists have suggested a variety of tactics that managers use to manage impression of fairness, including excuses, justifications, apologies, attempts to take responsibility for positive events and their consequences, and attempts to augment the positive implications of their actions (e.g., Greenberg, 1990; Tedeschi & Melburg, 1984; Tedeschi & Norman, 1985).

The impression management tactics interviewees used generally corresponded to those discussed in the literature. For instance, managers offered a variety of justifications and explanations for why punishment was required (category 11). Most of the justifications pertained to subordinate rule breaking, unsatisfactory performance, or undesirable attitudes, such as lack of commitment or dedication. Examples of these justifications include the following:

> I felt my authority was being directly challenged.
> There were many things that led up to this person being an undesirable employee as far as work habits, attendance. . . .
> Her attitude was so bad and she was very insubordinate that night.

The largest impression management category (category 10) represented the managers' attempts to blame the employees for not doing their parts, despite the managers' attempts to do what was right. For example:

> We were very pleasant to him . . . but it was his own personal thing. He just was very lax and couldn't be motivated.
> I had really gone out of my way to help . . . and to have them come back and lie to me. . . .
> He was told that if it happened again, it would result in termination. . . . He really created his own destiny in that situation.

This last category suggests that managers see punishment as embedded in a reciprocal social process. Both manager and subordinate have to do their parts to maintain the job relationship. If a subordinate doesn't live up to his or her part of this implied agreement, but the manager has done so, the manager's punishment action becomes more justifiable.

Other managers justified their actions in terms of its ultimately benefiting the organization or the subordinate. For instance, after firing an employee, one manager remarked of him

> He wasn't happy here. He'd be happier in a place where there are direct customer relations.

Many managers also commented on their role responsibilities as representatives of their organizations (category 12). These comments struck a note of obligation. Examples include these statements:

> It is your job and something you have to do.
> It was just part of my job to find out his problems and find out if it was our fault. If it was or not, we needed to deal with it.
> I wasn't happy about doing it, that's for sure. But, I knew it had to be done. In business there's some hard decisions you have to make and there are many of them you don't like. And you do them anyway.

It is also interesting to note that managers often admitted making errors or admitted that situations could have been avoided (categories 15 and 16). This finding supports our general subtheme of learning; many managers recognized that they had made mistakes and suggested that they learned from the experience.

Consistent with Arvey and Ivancevich's (1980) research, these findings suggest that managers use a variety of impression management strategies to communicate their competence, both to themselves and to others. These managers provided a variety of reasons why the punishments were necessary and the subordinates were to blame. They also felt pressure to punish stemming from managerial role responsibilities and generally claimed that they did their best. When they made mistakes in the process, they learned from them.

Attributions. The attribution process refers to individual's attempts to understand the causes of events, in this case the causes of the attitude or behavior problem that precipitated the punishment event. The presence of the attributions theme supports previous research (Mitchell et al., 1981), which demonstrated that managers form attributions regarding their subordinates' poor performance (categories 17 and 18). As in research on the actor-observer bias (Jones & Nisbett, 1972), in our findings the managers' attributions were much more frequently internal (frequency = 174) then external (frequency = 39). These internal (to the subordinates) causes of poor performance included age, attitudes, moods, irresponsibility, motivation, carelessness, laziness, physical or emotional problems, substance abuse, lack of ability, lack of knowledge, and lack of skills. For example:

> She was an alcoholic, and this precipitated the lost time, the lack of responsibility on her part, the tardiness, the whole issue.

External attributions included problems at home, peer pressure, role overload, differences in background or culture, and the specific circumstances preceding the incident. For example:

> I thought maybe [the infraction] was some kind of reaction to the loss of his wife.

As noted, most of the attributions were internal. The overwhelming internal focus of the attributions allowed managers to deflect responsibility for the problem away from themselves and convince the listener (and perhaps themselves) that they acted appropriately. Thus, these findings can be considered an extension of the previous impression management theme.

Awareness of and concern for subordinates. This theme contains two closely related subthemes: managers' awareness of the punished subordinates (their expectations, reactions, and so forth) and managers' concern for the punished subordinates' well-being. Previous literature suggests that when punishing a subordinate, a manager often considers factors that pertain to the subordinate's specific situation. These considerations include the subordinate's work history, the previous manager-subordinate relationship (Ball & Trevino, 1990; Fandt et al., 1990), and the seriousness of the subordinate's performance failure (Fairhurst et al., 1985; Mitchell et al., 1981). Our findings were generally consistent with this previous research, providing evidence that managers acknowledge subordinates and take them into account both in deciding whether to punish and in interpreting the punishment event. More specifically, these managers stated that they took subordinates' reactions—such as justice reactions (category 20)—and past work histories and past relationships with subordinates (category 21) into account when deciding whether (and to what degree) to punish them.

However, the findings indicated that managers consider a greater number of factors than previous research would suggest. Managers' statements suggested that subordinates sometimes accepted responsibility for their misconduct (category 23). For example, one manager said, "he realized that the problem was him, not the system." Further, some employees expected to be disciplined (category 22): "He said he knew it was coming." Finally, categories 25 and 26 suggested that managers are quite reluctant to punish their subordinates and are concerned about the subordinates as people with families and lives that will be affected. Statements representing this theme are:

> You are concerned and you always keep in the back of your mind that this is his livelihood.
>
> It was definitely a negative situation in the eyes of the employee that was terminated and it was one that I don't feel proud of, as far as putting somebody out on the street, somebody with a family and responsibilities just like the rest of us.

These results extend previous research in several ways that provide further evidence of managers' broad perspective on punishment situations. First, managers saw their subordinates as thinking human beings who sometimes expected punishment and took responsibility for their misconduct. This is far from the conventional behaviorist portrayal of subordinates as automatically having negative responses to punishment. Managers also portrayed their subordinates as feeling beings with families and responsibilities. These managers were clearly concerned with more than just the subordinates' performance, behaviors, and job attitudes; they were also concerned with their futures and livelihoods and the impact of the discipline on others close to them. This theme suggests that, for managers, the context surrounding punishment is wider than the workplace and that they view subordinates as much more than punishment targets. Managers came across as reluctant disciplinarians who were often sympathetic to the subordinates' family situations—aware that punishment can have far-reaching effects. Future researchers may wish to consider whether a subordinate's family status influences decisions about matters like the severity of a punishment and whether subordinates with families are given more opportunities to improve before being suspended or fired.

Awareness of and concern for co-workers and work groups. In this theme, the focus of attention and concern shifts to other employees, particularly those in the immediate work group of a focal subordinate. The presence of this theme suggested that managers are well aware of others' (especially their other subordinates') reactions to punishment events. Managers believe that their other employees expect them to punish wrongdoing and see doing so as fair (categories 27–30). Exemplary statements included "A lot of people felt that he should have been fired immediately" and "The others felt that it was a fair decision and that their well-being was looked out for."

Trevino (1992) argued that organizational punishment should be viewed as a social phenomenon that typically also involves "third-party observers." These observers make sense of what they observe and its implications for themselves and their group. The data supported these contentions. It was clear that managers were aware that their other subordinates knew about the punishment situations and had opinions about and reactions to them.

One category was not explicitly addressed by previous work. Managers were also aware that, beyond their other workers, their entire organization could be affected by a problem employee who was not dealt with appropriately. Negative effects on morale, finances, and customers were mentioned (category 31). This category suggests that, from the manager's perspective, researchers should broaden their view of punishment even more, stretching beyond punished subordinates and other subordinates to the effect of misconduct and its handling on organizations and even customers.

Fairness concerns. For the most part, past research drove our placement of categories within this theme. The organizational justice literature suggests that people evaluate fairness from two perspectives: distributive and procedural justice (e.g., Greenberg, 1987). Distributive justice concerns the fairness of outcome distributions (e.g., Adams, 1965). For example, to be distributively fair, punishment outcomes should be administered consistently across subordinates, situations, and time, and they should be clearly tied to (contingent on) the misconduct and administered at a level appropriate to it (Ball, Trevino, & Sims, 1994).

Procedural justice concerns the fairness of the decision-making process (e.g., Leventhal, Karuza, & Fry, 1980; Lind & Tyler, 1988; Thibaut & Walker, 1975). The punishment and procedural justice literatures have also suggested several procedural factors. For example, "constructive" punishment refers to managers' attempts to correct and improve undesirable subordinate behavior through techniques such as teaching, counseling, and constructive criticism (Baron, 1988). Writers on punishment have also long proposed that punishment should be carried out in private and in a timely manner (e.g., Arvey & Ivancevich, 1980; Arvey & Jones, 1985; Sims, 1980). Finally, research has shown that reactions to bad news are more positive when causal accounts (i.e., clear explanations) are given (e.g., Bies, Shapiro & Cummings, 1988).

Our results were generally consistent with this literature. Managers did discuss topics that could be classified in terms of distributive and procedural fairness. For example, they talked about punishment contingency (category 32), equity (category 36), and severity (category 34), all notions reflecting distributive fairness. Touching on procedural fairness, they discussed constructiveness (category 33), privacy (category 35), and timing (category 37).

Two additional procedural categories seemed uniquely manager-centered. First, several managers expressed the need to be flexible when selecting punishment procedures. They felt that they should use judgment to consider individual circumstances and that they needed to make exceptions at times (category 39). Examples were

> What if a good soldier made a mistake? What if a dud is continually making mistakes? . . . They don't deserve the same punishment even if they did the same crime.

> Some people you can counsel them and they will see the errors of their ways. Others you have to use more harsh punishment to get their attention.

Second, by far the largest fairness category (category 38) pertained to a general concern for following punishment procedures that either a union contract or a personnel department prescribed; such procedures include involving the personnel department, providing evidence and documentation, issuing warnings, and providing explanations. For instance, one interviewee said

> I had the industrial relations people and my immediate supervisor put on notice that [the incident] was going on. We officially had the files adjusted to show that he was on probation. And, after the three months [probationary period] . . . we met again.

These results suggest that managers' concerns about fairness in punishment situations focus more on the procedural aspects than on distributive concerns. This conclusion is particularly interesting when compared to the work of Ball, Trevino, and Sims (1994), which suggested that punished subordinates are influenced more by distributive aspects of a disciplinary event—such as its severity and consistency—than by procedural issues.

Although previous research has linked punishment and fairness, it has not done so from a managerial perspective. The results of this research suggest that managers are clearly concerned about fairness. However, because organizational due process systems emphasize procedures (warnings, documentation, etc.), managers seem to be focusing more on those than on the distributive issues that may be most important to their subordinates. Thus, a mismatch may exist between managers' and punished subordinates' perceptions of punishment fairness. Future research should investigate this potential disparity and its consequences.

Punishment as an emotional experience. Finally, nine categories (40–48) provide the first empirical evidence of the highly charged emotional nature of punishment for managers, employees, and observers. The evidence suggests that managers perceived the atmosphere surrounding punishment episodes to be highly emotional (category 48), with most of the emotions being negative. However, managers did admit to having mixed emotions themselves (category 42) and acknowledged that punished subordinates sometimes experienced mixed or even positive emotions (categories 45 and 46) as a result of being disciplined.

Our data generally support previous conceptual work, in particular, Ball and Sims's (1991) suggestion that punishment is a complex cognitive and emotional process for managers as well as subordinates, and that the emotions involved are most likely negative. In these interviews, managers talked about their own feelings, and the feelings they expressed were overwhelmingly negative (132 statements regarding managers' negative affect compared to only 26 statements regarding positive or nonnegative affect). The following are some of the negative words and phrases managers used to describe how they felt:

> I was completely frustrated.
> I guess later I felt sorry for him.
> It made me angry.
> I must have been partially to blame . . . I was embarrassed.
> It's a bad feeling . . . You watch this person, you try to give your energy, your input . . . it's kind of like a failure on your part.

Several managers also talked about the punished subordinates' emotional reactions. Again, most of the discussion focused on the negative emotions generated by the punishment. Managers perceived the punished subordinates as experiencing a wide variety of emotions, including defensiveness, fear, discomfort, embarrassment, resentment, frustration, guilt, dissatisfaction, bitterness, disappointment, hostility, shock, fury, unhappiness, awkwardness, and anger.

Managers also made a large number of statements about the wide variety of emotions expressed by their other subordinates. Although usually negative, these emotions were not always so; positive emotions on the part of other subordinates, such as relief, pleasure, happiness, sympathy, surprise, and satisfaction, were also mentioned.

Finally, managers displayed an awareness of what might be termed the overall affective atmosphere surrounding the punishment incidents. These statements reflected employee moods that prevailed within an office at the time of the discipline as well as general, depersonalized statements regarding the "mood" of the incident.

Overall, these findings suggest that managers report primarily negative emotions surrounding the incidents but that managers, the punished subordinates, and other organizational members also occasionally experienced nonnegative (and even positive) emotions. This is the first study to document the highly charged emotions managers feel in punishment situations. The findings suggest that supervisory training should incorporate this knowledge to help managers deal more effectively with their own feelings and the feelings of others.

Differentiating between Effective and Ineffective Punishment Incidents

Our final goal was to find out how managers distinguished between effective and ineffective incidents. The overwhelming finding here is that most of the categories did not allow significant differentiation between effective and ineffective incidents, suggesting that managers think about the two in similar ways—they think about the instrumental outcomes, they feel the need to justify their behavior, they try to understand the causes of performance problems (attributions), they think about fairness and feelings and are concerned about the punished subordinates and what others will think and how they will react.

However, a few of the categories do offer differentiation between effective and ineffective incidents and are noteworthy. First, managers were more likely to discuss positive outcomes and the fact that the punishment worked in effective incidents (categories 1 and 2). Similarly, they were more likely to discuss negative outcomes and the fact that the punishment didn't work in ineffective incidents (categories 3 and 4). These findings clearly support the traditional instrumental view of punishment effectiveness.

Five additional categories (6, 9, 27, 32, and 39) represented types of statements managers were significantly more likely to make in disciplinary situations they identified as effective: They were more likely to discuss the respect gained from subordinates, to provide advice and to share their own theories of punishment effectiveness, and to acknowledge their other workers' reactions (e.g., co-workers' awareness of the misconduct and their desire to see something done about it). Managers also were more likely to use "if/then" contingency statements when discussing effective incidents, expressing a clear relationship between the misconduct and the punishment outcome. Finally, managers were more likely to talk about the need for flexibility in effective incidents. Thus, managers connect effective incidents with an awareness of work group expectations, concerns about disciplinary process issues such as flexibility, and instrumental relationships with a number of positive outcomes, including subordinate respect.

Only one additional category represented statements managers were significantly more likely to make in ineffective incidents. This was category 20, referring to knowledge of subordinates' reactions concerning justice or injustice. Most of the statements in that category referred to a subordinate's perception that she or he had been treated unfairly in the punishment incident. It appears managers connect ineffective punishment incidents with subordinates' injustice claims.

For each category, Table 2 displays (1) the number of managers who made more statements representing that category when discussing effective incidents than ineffective incidents, (2) the number of managers who made more statements representing that category when discussing ineffective incidents than effective incidents, and (3) the results of the McNemar test.

IMPLICATIONS FOR RESEARCH AND PRACTICE

Our further study and analysis of the findings contributed to the development of an inductive model of punishment from a managerial perspective that brings together variables addressed in previous research and variables that emerged from this study. Figure 1 graphically depicts the model. The "manager as disciplinarian" stands at its center. The model highlights the key relationships, influential variables, processes, and outcomes that are important to understanding punishment from a manager's perspective. It also suggests research and management implications beyond those already addressed.

In the more conventional subordinate-centered perspective on punish-

TABLE 2
Comparison of Effective and Ineffective Incidents[a]

Category	Number of Managers Who Made More Such Statements about Effective Incidents	Number of Managers Who Made More Such Statements about Ineffective Incidents	χ^2
Instrumental nature of punishment			
1. Positive outcomes/punishment worked	53	5	39.72*
2. General positive outcomes	27	13	4.90*
3. Negative outcomes/punishment didn't work	2	19	13.76*
4. General negative outcomes	6	35	20.51*
5. Mixed outcomes (positive and negative)	9	14	1.09
6. Manager's desire for respect/integrity from subordinate and others	9	2	4.45*
7. Manager's concern for/recognition of vicarious effects on co-workers	18	19	0.03
8. Positive outcomes for manager/organization	2	6	2.00
Impression management			
9. Manager's implicit theories/advice regarding management/punishment	19	4	9.78*
10. Manager did his/her part, employee didn't respond/do his/her part	15	25	2.50
11. Manager justifications for/reasons for punishing	12	20	2.00
12. Manager's role responsibility	16	13	0.31
13. Manager searched for more information	8	5	0.69
14. Manager/management made no mistake/handled situation properly	13	12	0.04
15. Manager/organization made a mistake	11	10	0.05
16. Situation should never have happened/could have been avoided	8	9	0.06
Attributions			
17. Manager's understanding based upon internal attributions	19	22	0.22
18. Manager's understanding based upon external attributions	10	11	0.05
Awareness of and concern for subordinate			
19. Miscellaneous subordinate reactions	27	18	1.80
20. Knowledge of subordinate's justice/injustice reactions	3	11	4.57*
21. Positive history	11	9	0.20
22. Subordinate expected punishment	6	8	0.29
23. Subordinate accepted responsibility for wrongdoing	12	7	1.32

TABLE 2 (continued)

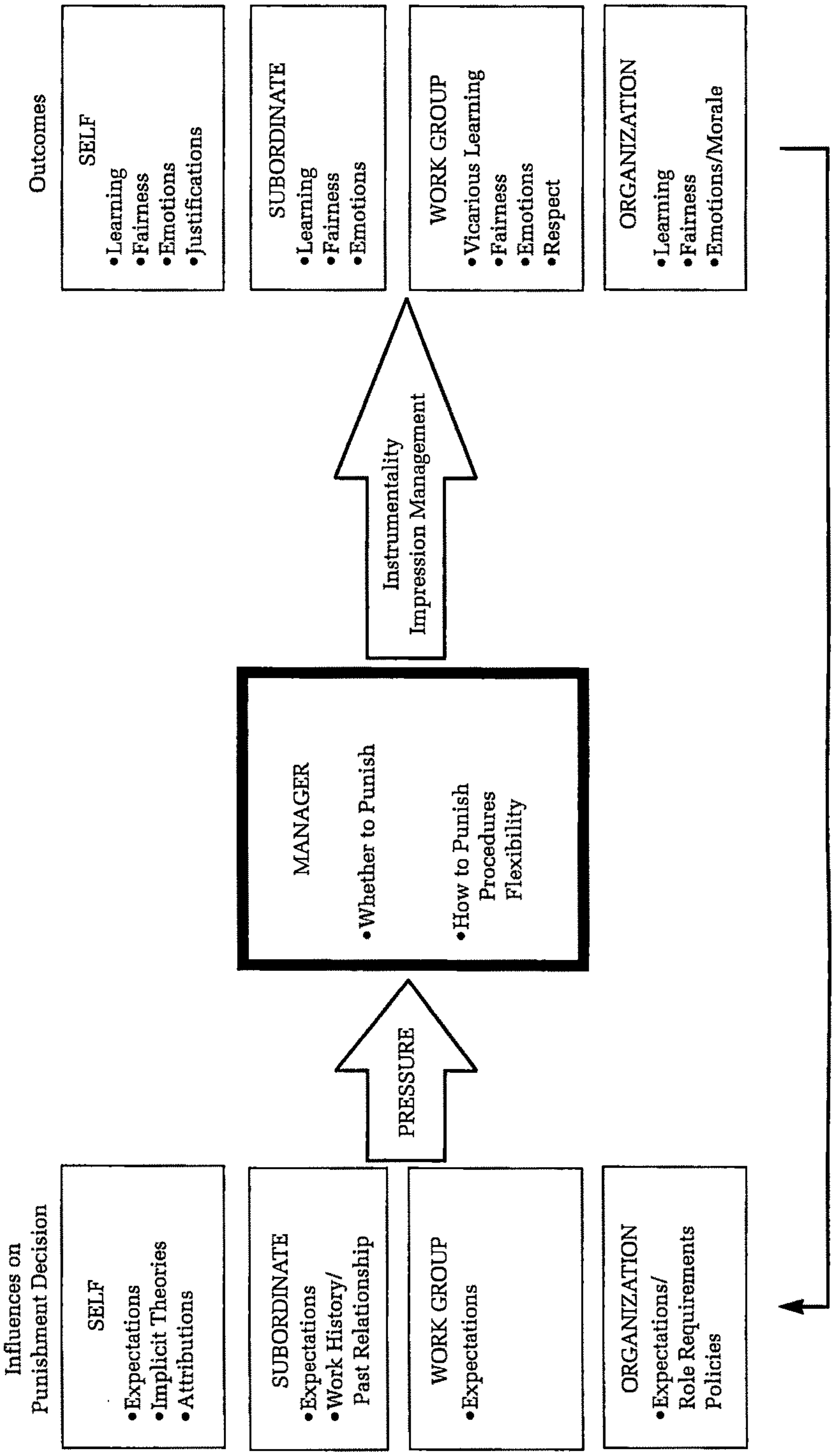
Category	Number of Managers Who Made More Such Statements about Effective Incidents	Number of Managers Who Made More Such Statements about Ineffective Incidents	χ^2
24. Subordinate did not accept discipline/responsibility	9	9	0.00
25. Manager's interest in/concern for person/family/livelihood	16	10	1.38
26. Manager's reluctance to punish	20	12	2.00
Awareness of and concern for co-workers/others			
27. Co-workers'/others' nonemotional reactions to punishment	15	6	3.86*
28. Co-workers'/others' knowledge of/reaction to misconduct	8	16	2.67
29. Co-workers'/others' knowledge of/expectations of punishment	7	7	0.00
30. Knowledge of others'/co-workers' justice/injustice reactions	10	7	0.53
31. Manager's concern for organization	20	12	2.00
Fairness concerns			
32. Concern for punishment contingency	19	7	5.54*
33. Concern for constructiveness	11	12	0.04
34. Concern about punishment severity	8	6	0.29
35. Concern for privacy	15	13	0.14
36. Concern for equity/consistency	3	2	0.20
37. Concern for timing/timeliness	3	1	1.00
38. Concern about punishment procedures	30	26	0.29
39. Punishment should be flexible	16	4	7.20*
Emotions			
40. Manager's negative emotions	26	20	0.78
41. Manager's positive and/or nonnegative affect	13	7	1.80
42. Manager's general or mixed emotions	7	4	0.82
43. Others'/co-workers' emotional reactions	10	18	2.29
44. Subordinate's negative emotional reactions	18	22	0.40
45. Subordinate's positive and/or nonnegative affect	9	7	0.25
46. Subordinate's mixed feelings/general feelings	3	2	0.20
47. Manager's lack of feelings (e.g., no emotion, calm)	4	7	0.82
48. Punishment atmosphere as emotional/tense	5	6	0.09

[a] $N = 76$. The chi-square results are based on the McNemar test (Daniel, 1990).

* $p < .05$

FIGURE 1

An Inductive Model of Punishment from the Manager's Perspective



ment, subordinates were the focus of decision-making concern, the key relationship was that between subordinate and supervisor, and the important outcomes were the subordinates' attitude and behavior changes and potential negative side effects. The manager-centered perspective suggests that managers view punishment in a broader and more complex manner than past work has suggested. As disciplinarians, managers experience cognitive and emotional complexity and participate in a set of important relationships; they are both influencing and being influenced by their organizations, work groups, subordinates, and selves.

Multiple Influences on Manager's Punishment Decisions

Managers making decisions about whether and how to punish are central to this model. The arrow pointing in the direction of the manager represents the various pressures placed on a person in this role regarding these decisions. Past research has suggested that managers' punishment decisions are influenced by variables that have to do with themselves (e.g., attributions), the subordinates involved (e.g., work history, performance failure, evidence of misconduct), and the relationship between the two parties (Fairhurst et al., 1985; Fandt et al., 1990; Mitchell et al., 1981). The model that emerged from this research expands the influences on managers' decision making considerably by incorporating influences of work group and organization and additional influences of the managers themselves.

A common influential variable, operating at multiple levels, is expectations, many of which push managers in the direction of punishing. A manager's own expectations are derived from implicit theories of good management and disciplinary practice that can affect the decision to punish or not to punish as well as the punishment process. These expectations, combined with overwhelmingly internal attributions, generally push the manager to punish. In addition, subordinates have expectations that are based upon their histories and relationships with their supervisors. Somewhat surprisingly, subordinates sometimes expect to be punished. Work group members also expect that rule violators will be punished and that managers will fulfill the disciplinary part of their role, and managers are very aware of these expectations. Finally, organizations create and impose managerial role requirements as well as disciplinary policies and procedures that managers feel compelled to carry out. Therefore, managers see themselves as pressured by expectations from multiple sources and levels, many of which seem to be pushing them toward punishing.

Decisions about how to punish are also influenced by these expectations, particularly by managers' concerns with following organizational policy and procedures at the same time they are trying to be flexible and to consider their subordinates' specific circumstances. In making these decisions, managers are aware that their other subordinates, the punished subordinate, and the organization will all evaluate their actions.

An Array of Punishment Outcomes

In Figure 1, the arrow pointing from the manager to outcomes represents instrumentality and impression management, two prominent mechanisms by which managers' punishment decisions affect themselves, punished subordinates, work groups, and organizations. Previous approaches to punishment represented a narrow instrumental view, focusing on the effects of punishment on a subordinate's subsequent attitudes and behaviors, in particular on avoiding negative side effects. This research suggests that managers see punishment as instrumental in accomplishing a wider variety of goals related to multiple constituencies. The view of managers goes beyond the obvious instrumentality of punishment's effects on subsequent attitudes and behaviors; managers see punishment incidents as highly charged cognitive and emotional events with far-ranging implications for a variety of outcomes, including—but not limited to—learning, fairness perceptions, emotions, respect, and employee morale.

Learning is a common instrumental outcome that emerged across multiple levels. First, as did previous researchers, we found that managers believed that punished subordinates could benefit from punishment experiences and were likely to have improved work performance. Second, managers were concerned about the messages they were sending to the rest of their subordinates by their actions. Perhaps most important is managers' awareness of the vicarious learning that took place as a result of their decisions to either punish or not to punish. Finally, managers considered their own potential to learn from the events as well as the potential for organizational learning.

Managers were also aware of and concerned about fairness issues at multiple levels. In contrast to subordinates' tendency to focus on issues of distributive justice, managers' own fairness concerns tended to focus on procedural issues, such as whether organizational policies and procedures were followed. Managers were also frequently aware of and concerned about the fairness perceptions of punished subordinates, their work groups, and their larger organizations.

Evidently, managers are aware that punishment is a highly salient issue and that their actions can influence the impressions they make on all of their workers. As a result, punishment situations offer more to managers than a means for achieving desired outcomes; punishment situations also present opportunities for impression management.

Finally, managers are also aware of and concerned about emotional reactions (which they perceive as mostly negative) to highly charged punishment events. These reactions range from their own reactions through those of the punished subordinates and their work groups to morale in general. All of these outcomes—learning, fairness perceptions, emotions—then feed back into ongoing expectations and punishment decision-making processes.

Implications for Future Research and Management Practice

This research, grounded in managers' punishment experiences, has contributed to knowledge about organizational punishment by supporting previous theory and research and by providing a broader and deeper understanding of punishment from a manager's perspective. Numerous insights emerged from the data, several of which offer potential avenues for future research.

One way to draw implications from the model is to consider what these managers did not discuss. For example, it was interesting to note that the managers interviewed for this study talked little about the negative side effects of punishment that are so much a focus of the previous literature. Admittedly, the impression management category suggests that managers were trying to put a positive face on an unpleasant task. However, the managers discussed an equal number of effective and ineffective incidents. Therefore, it remains somewhat surprising that there was little discussion of problems such as sabotage or workplace violence resulting from punishment. Discussion of subordinates' negative emotional reactions comes closest to capturing this conventional concern. However, managers were almost as concerned with their other workers' emotional reactions as they were with those of the punished subordinates.

Also, managers did not talk about their peers or their superiors. The data suggest that managers don't discuss disciplinary problems or practices with other managers. And, although they often referred to their organizations (their expectations, policies, and learning outcomes), the managers' superiors were surprisingly absent from the discussion, suggesting that disciplinary practices may not be an important part of their superiors' evaluations of them. In general, these managers came across as isolated decision makers who reluctantly made tough disciplinary decisions without seeking or receiving guidance or input from their peers or superiors.

In addition, because managers in this study talked about situations in which they decided to punish, the data don't address situations in which they decided to ignore a problem situation or to take some action other than punishment. Therefore, for an even broader understanding, future research should consider the restraining factors that keep managers from punishing. Asking managers to talk about performance problems and how they dealt with them might provide insight into alternatives to or substitutes for punishment that managers may use when struggling with disciplinary problems.

We can also draw a number of implications by examining what managers did discuss. First, future research should reflect the expanded perspective offered by this model. For example, attempts to predict a manager's decision to punish should include multilevel influences from organizational punishment procedures, work group expectations and concerns about vicarious learning, and the more typical variables such as attributions and subordinates' characteristics and past work performance. Studies of punishment outcomes (justice perceptions, emotions, impressions) should take into account work group reactions and organizational outcomes as well as subordinate reactions. Also, a more complete multiperspective understanding of punishment incidents will require that data be collected from multiple parties involved in a disciplinary event (Ball et al., 1994).

Future studies may also wish to explore in more depth managers' implicit theories of what constitutes good disciplinary practice and what managers think they can do to make a good impression on others. Ferris, Russ, and Fandt (1989) suggested that impression management is more likely to occur when few constraints prevent it, when there is uncertainty and ambiguity, and when actors are self-conscious. Therefore, these interview situations represented nearly ideal circumstances for impression management. However, it would be particularly interesting for future investigations to consider the impression management tactics managers might use with different audiences with an interest in a punishment event.

Explanations and justifications for punishment are an additional avenue for future research. These managers provided a variety of explanations and justifications to the interviewers. But the data did not capture the explanations and justifications provided to punished subordinates and to work groups. The procedural justice literature suggests that explanations can improve reactions to bad news or negative outcomes (e.g., Bies et al., 1988), but the organizational punishment literature has just begun to explore this effect (Ball et al., 1994). Future investigations may wish to consider the types of explanations and justifications managers are likely to provide in different punishment situations and the effects of these on outcomes for different constituencies.

We see this study as providing input to management training that has taken a rather narrow view of punishment in the past. Managers have been provided with a list of dos and don'ts that focus on finding alternatives to punishment if at all possible and on avoiding negative side effects stemming from actions of punished subordinates if punishment becomes necessary. This research suggests that managers should be educated to view punishment in a much more complex manner, taking into account work group and organizational expectations, as well as those of punished subordinates. Further, it may help managers to understand the wide variety of potential outcomes of a punishment event, including the potential for learning at all levels.

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APPENDIX

Interview Protocol

(1) **Incident background.** Tell me in your own words the background of the incident. In other words, how did this incident come about? What led up to it? (If the following questions are not answered, ask:)

Who was involved?
What were their relationships?
What led up to the incident?
What was the person being disciplined for?
What was the infraction?
Was it a formal rule or a more informal norm that was broken?
Was it a first or repeat offense?

(2) **The incident.** Now, thinking about the same disciplinary incident, tell me what happened. In other words, how was the discipline carried out? (If the following questions are not answered, ask:)

What did the discipliner say or do?
What did the disciplinee say or do?
Who knew about it? How did they find out?
Were other people involved? How?
What form did the discipline take (verbal reprimand, suspension, demotion, termination, etc.?)

(3) **Emotions.** Continuing to think about the same incident, please describe the emotions and feelings that surround the incident. How did you feel about it? Why? How did others feel about it? Why? (be sure to get at the *whys*)

Was it fair, just, appropriate? Why?
Would some other disciplinary action have been more appropriate? Why?
Were you pleased, happy? Why?
How did the person being disciplined feel? Why?
How did others feel? Why?

(4) **Outcomes.** What was (were) the outcomes of this disciplinary incident? Why do you think it turned out the way it did?

What were the positive outcomes? Why were they positive?
What were the negative outcomes, if any? Why were they negative?
Did the discipline have the intended effect? Why?
Did the person's behavior improve? Why?
Did the discipline help to clarify the person's job?
Did the discipline help to clarify what is appropriate/inappropriate behavior?

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IS GROUP PRODUCTIVITY LOSS THE RULE OR THE EXCEPTION? EFFECTS OF CULTURE AND GROUP-BASED MOTIVATION

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This study examined four causes of group performance loss: goal specificity, communication, incentives for goal attainment, and high versus low cultural collectivism. Subjects were managers from Israeli kibbutzim (63 individuals) and cities (59 individuals) who worked on a simulated task requiring them to evaluate résumés. We used a two-by-three-by-four design in which sample, goal, and test condition were varied to test hypotheses. Group performance loss occurred only for urban respondents with a do-your-best goal and team task.

Western corporations have shown a growing interest in teamwork, but research evidence has not fully supported great hopes that teamwork will increase organizational effectiveness. In fact, in the results of numerous studies, people working together have not performed as well as they performed when working alone, even when process loss was controlled for (Gabrenya, Latane, & Wang, 1983; Latane, Williams, & Harkins, 1979). This phenomenon of individuals exerting less effort when their efforts are combined than when efforts are individual is known as social loafing (Levine, Resnick, & Higgins, 1993; Shepperd, 1993). A meta-analysis of 78 studies on social loafing led to the conclusion that the effect is robust and generalizes across tasks and work populations (Karau & Williams, 1993). However, a large number of variables moderate the tendency to engage in social loafing. For example, social loafing was eliminated when participants worked with close friends or teammates, when there were clear performance standards, and when individual output could be evaluated. In addition, social loafing was not apparent when tasks were meaningful, when people did not feel that their input was redundant, when they did not think others were taking advantage of them, and when the culture in which they were embedded supported contribution to a group. Since most groups in organizations consist of individuals who work together and get to know each other, one wonders whether social loafing is indeed the rule or the exception. This study was designed to answer this question by simulating working conditions in which the members of a working team know each other, communicate with each other, and have clear performance standards and rewards for performance. We examined these effects in group-focused and self-focused cultures.

SOCIAL LOAFING VERSUS SOCIAL FACILITATION

Social loafing is often explained by the attributions people make about the motivation and performance of other group members. First, people may believe that other group members exert enough effort to achieve a group's goals, thereby making their own efforts unnecessary or dispensable. This phenomenon is often called the free-rider effect (Kerr, 1983). Second, a potential inequity in contributions may occur when one person contributes more than others. To avoid the possibility of becoming a sucker, that is, one who contributes to the collective good when nobody else does, individuals attenuate their efforts and cause an overall loss in group performance (Kerr & Bruun, 1983; Kidwell & Bennett, 1993).

However, a separate line of research has suggested that working in the presence of others may, in fact, increase the level of performance compared to working alone. This effect is known as social facilitation, which is the result of people's motivation to maintain a positive self-image in the presence of others, particularly when they perceive the others as potential evaluators. Three factors, the mere presence of others, evaluation apprehension, and motivation to maintain a positive self-image, account for the social facilitation effect. First, the mere presence of others affects behavior by increasing an individual's general level of arousal (Guerin, 1986). Arousal enhances the emission of dominant and familiar responses. Therefore, the presence of others increases performance on tasks that require familiar responses, but impairs performance on tasks that require novel responses, because overarousal occurs (Zajonc, 1965). Alternatively, the mere presence of others may create a cognitive overload, which can cause either performance increment or decrement, depending on the information-processing demands of the task (Baron, 1986).

Second, the presence of others increases evaluation apprehension. It affects the focus of attention and creates demands on a person to behave in a certain way and to gain positive evaluation. Harkins (1987) showed that the presence of others and evaluation apprehension have an additive effect on performance. These two effects occurred when the performers could be identified and their performance could be compared to certain standards or norms.

Third, the presence of others causes people to focus attention on the self, and to become aware of potential discrepancies between the actual and the ideal self (Wicklund, 1975; Wicklund & Duval, 1971). Self-awareness creates demands on a person to behave in a certain way and to accomplish a certain level of performance. Self-awareness can either enhance or impair performance, depending on how it affects motivation and attention. The mental resources allocated to self-evaluation are taken out of a pool of limited resources that are allocated to perform the task. Therefore, self-regulatory processes may impair performance of novel or complex tasks that require high levels of attention (Kanfer & Ackerman, 1989).

The lines of research on social loafing and on social facilitation have been developed separately from each other, and in most social psychology textbooks accounts of that research have appeared in separate sections: social loafing appears as a subcategory of group performance, whereas social facilitation appears as a subcategory of coaction—the effect of the presence of others working independently on the same task (Harkins, 1987).

Two major differences distinguish past research on social loafing and social facilitation: the presence of others, and evaluation by others. Both existed in the social facilitation research but were often missing in the social loafing paradigm. In most social loafing studies, individual performance was not identifiable and could not be evaluated.

Evaluation apprehension is enhanced when there are clear measures of performance, when there are standards, or norms against which performance can be compared, and when feedback is provided (Guzzo & Shea, 1992; Pritchard, Jones, Roth, Stuebing, & Ekberg, 1988). The presence of performance measures and performance standards facilitates group evaluation and increased group performance (Harkins & Szymanski, 1989). Loafing is minimized by increasing the identifiability and uniqueness of members' task contributions (Harkins & Szymanski, 1989) and by increasing personal accountability and personal responsibility (George, 1992; Wagner, 1995; Weldon & Gargano, 1988; Weldon & Weingart, 1993).

We argue that traditional research on social loafing has often been conducted in artificial groups that did not conform with the definition of groups as involving people's mutual awareness and potential mutual interaction (McGrath, 1984): First, the presence of others, a major characteristic of groups that enhances evaluation apprehension, was missing in almost all of the studies on social loafing (exceptions are Erev, Bornstein, and Galili [1993] George [1992], Wagner [1995], and Weldon, Jehn, and Pradham [1991]). In some of the studies there were pseudo groups—subjects did not perform in the physical or social presence of others, but rather, were led to believe that they were part of a group (Earley, 1989, 1993; Latane et al., 1979). For example, Earley told his subjects that "they were one of ten managerial trainees who would be working on the in-basket task" (1989: 573). Each "trainee" was seated individually at a table, and "subjects were led to believe that they are performing the task with others, although they are actually performing alone" (Earley, 1989: 565). In other cases, partitions were put between group members so that they could not see, hear, or communicate with each other (Harkins, 1987; Harkins & Szymanski, 1989; Sanna, 1992).

Second, communication among group members, a major characteristic of interactive groups, could not occur in the pseudo groups, or when group members were separated by partitions. Communication enhances both awareness of the presence of others and evaluation apprehension. In social dilemma situations in which individuals may receive higher payoffs for noncooperation than for cooperation, communication has been found to be an effective method of eliminating social loafing (Shepperd, 1993; Weldon et al., 1991) and enhancing cooperation (Chen & Komorita, 1994; Edney & Harper, 1978; Wagner, 1995). Communication and interaction among group members have been shown to increase commitment and group performance (Matsui, Kakuyama, & Onglatco, 1987), and groups with both a group goal and group feedback for reciprocal task interdependence had better performance than groups with low levels of interaction (Mitchell & Silver, 1990; Saavedra, Earley, & Van Dyne, 1993; Straus & McGrath, 1994). Communication between subordinates and superiors improved superiors' performance when subordinates were knowledgeable (Scully, Kirkpatrick, & Locke, 1995), and participation in goal setting and group discussion led to the highest level of commitment to personal goals and to individual performance (Erez, 1993; Erez & Arad, 1986; Latham, Erez, & Locke, 1988).

Third, in most of these studies subjects did not have specific group performance goals, and they did not receive feedback on performance (Harkins, 1987; Harkins & Szymanski, 1989; Latane et al., 1979; Weldon & Gargano, 1988; Williams, Harkins, & Latane, 1981). Only a few studies have incorporated goals when testing group productivity loss (Earley, 1989, 1993; Sanna, 1992; Shepperd & Wright, 1989; Weldon et al., 1991). The absence of goals and feedback impaired evaluation apprehension.

Incentives reinforce emphasis on goal attainment and feedback. People become more committed to their goals when goal attainment leads to rewards (Locke & Latham, 1990). Three types of rewards serve to overcome social loafing: economic rewards for group accomplishment, including money and awards; social rewards of liking, group membership, and status; and self-rewards that are experienced when a task is intrinsically interesting and when performance is personally valued (Shepperd, 1993). Previous research has demonstrated that rewarding a group for goal attainment or for successfully competing against other groups mitigates the effect of social loafing (Erev et al., 1993; Shepperd & Wright, 1989; Zaccaro, 1984).

In sum, social loafing can be eliminated when the members of a group are all present, work together, communicate with each other, and have specific standards and performance goals, and when goal accomplishment is reinforced. All these conditions that eliminate social loafing coincide with the definition of a group as involving mutual awareness and potential mutual interaction among group members (McGrath, 1984). However, social loafing may occur under certain conditions that do not allow people to develop mutual awareness and cohesiveness: when groups are formed temporarily or are in an early stage of formation.

LOAFING, SELF, AND CULTURE

Culture has relevance for understanding the effect of social loafing. Earley (1989) demonstrated that group members with highly collectivistic values did not loaf and contributed to their groups' performance, whereas members with individualistic values loafed, in particular when they were not held personally accountable for performance. Earley also showed that social loafing rarely occurred in collectivist cultures like China but occurred more often in individualistic cultures like the United States. Individuals in collectivist cultures, including China and Israel, contributed to group performance when they were led to believe that they were working in in-groups but did not do so when working in out-groups or alone. Individuals in individualistic cultures like the United States performed better when they were working alone than when working either in in-groups or out-groups (Earley, 1993). These findings reinforce Hackman and Oldham's conclusion that "unless the case of self-managing work groups is compelling, it may be more prudent in traditional organizations to opt for the less radical alternative of enriching the jobs of individual employees" (1980: 225).

The reason social loafing does not occur among collectivists is that they place group goals and collective action ahead of their own interests. In contrast, individualists are motivated by personal gain, and contribution to the group is inconsistent with self-interest, unless they are held personally accountable for, and personally responsible for, their groups' performance (Earley, 1989, 1993). Individuals with highly individualistic values are less likely to behave cooperatively than collectivists. Collectivists' cooperative behavior is not contingent upon group size or individual identifiability, whereas cooperative behavior by individualists is more often observed in small rather than large groups, and when they can be personally identified (Wagner, 1995).

Collectivist values reflect how members of one culture relate to each other and how important it is for them to belong to their social groups. These values include self-definition as part of a group, subordination of individual goals to group goals, concern for the integrity of the group, and an emotional attachment to an in-group. The major themes of individualism are self-definition as an entity distinct and separate from a group, emphasis on personal goals, and little concern for and emotional attachment to an in-group (Triandis, Bontempo, Villareal, Asai, & Lucca, 1988; Triandis, Leung, Villareal, & Clark, 1985). Collectivists, unlike individualists, define the self as an entity extending beyond the individual to include a particular group of others (Wagner, 1995).

People in different cultures use the concept of collectivism/individualism to evaluate the desirability of attachment to others and its impact on their notions of self-worth and well-being (Erez, 1994; Erez & Earley, 1993). In collectivistic cultures, there is low differentiation between self and others. People stress similarities with other group members, and their selves are defined in relational terms. People in collectivistic societies see themselves as part of an encompassing social relationship, and they recognize that their own behavior is affected by what they perceive to be the thoughts, feelings, and actions of others. The representation of collectivistic values in a person's self-definition shapes the "interdependent self" (Markus & Kitayama, 1991; Triandis, 1989).

In contrast, in individualistic cultures there is a clear differentiation between self and others, and the normative imperative is to become independent from others and to discover and express one's unique attributes. The essence of individualistic values involves a conception of the self as an autonomous, independent person. The representation of these individualistic values in a person's self-definition shapes the "independent self" (Markus & Kitayama, 1991; Triandis, 1989). It should be noted that every person has both independent and interdependent selves, and one or the other dominates, depending on the individual's cultural values.

One of the methods that is commonly used to assess the independent and the interdependent self is the Twenty Statement Test (Cousins, 1989; McPartland, Cumming, & Garretson, 1961; Trafimow, Triandis, & Goto, 1991), which requires people to make 20 statements about themselves beginning each with the words "I am . . . ." This projective test allows people to express themselves openly. Therefore, it captures personal variability more than a structured five-point Likert-type scale. Responses are content-analyzed and classified into categories that reflect the independent or the interdependent self. For example, a reference to a social role (e.g., "I am a son" and "I am a member of the Academy of Management") reflects the interdependent self. A statement of a personal attribute, existing independent of others (e.g., "I am 18 years old," "I am ambitious") is an expression of the independent self. McPartland and colleagues first used the scale to assess the relationship between the self-concept and withdrawal behavior of patients newly admitted to psychiatric hospitals. They found that patients whose self-concepts were dominated by statements reflecting their physical characteristics were more withdrawn than those defining themselves in relational terms. More recently, the measure was implemented to assess cross-cultural differences in levels of independent and interdependent selves. Consistent with their individualistic views, Americans were found to have salient independent selves, whereas Japanese and Chinese people had salient interdependent selves, consistent with their collectivistic values (Cousins, 1989; Trafimow et al., 1991).

An individual's independent and interdependent selves evaluate teamwork and the opportunity to contribute to team performance differently. Working with others and contributing to a group fulfills the interdependent self and strengthens a person's sense of belonging to the group. Individual contribution to a group is less meaningful to the fulfillment of the independent self because its self-definition is not in relational terms. Contribution to a group becomes meaningful for the individual self only when a person is held personally accountable for group performance and when his or her contribution to the group can be identified and evaluated.

The interdependent self is more attuned toward evaluation by others than the independent self, in particular when others are part of the immediate reference group. For this reason, perhaps, Chinese managers with strong interdependent selves did not loaf when they were led to believe that they were part of an in-group as they did when they thought they were part of an out-group. In contrast, American managers with strong independent selves are guided by self-evaluation, and contribution to a group is less central to their values than it is to managers in collectivistic cultures. Therefore, they attenuated their performance while working in groups (Earley, 1993).

In line with the model of cultural self-representation (Erez & Earley, 1993), employees in collectivistic cultures will positively evaluate the opportunity to contribute to group performance because it enhances their interdependent selves. Cultural values shape the independent and the interdependent self. They serve as criteria for evaluating the contribution of certain motivational and managerial techniques to a person's sense of self-worth and well-being. Positive evaluations result in commitment and adherence to a motivational technique, whereas negative evaluations inhibit commitment and performance. Collectivistic values are represented in the interdependent self, whereas individualistic values are represented in the independent self. Therefore, group performance loss is more likely to occur in individualistic cultures, where contribution to the group does not directly enhance the independent self, but it will not occur in collectivistic cultures, where contribution to the group satisfies the interdependent self.

The purpose of the present study was to examine the following effects on group performance loss: the effect of cultures with high and low collectivism as they are represented by the interdependent versus the independent self; the effects of specific group goals, general group goals, and individual goals; the impact of communication among group members; and the impact of incentives. These four factors influence both awareness of the presence of others and evaluation apprehension, which further affect individual contribution to a group. We tested two hypotheses concerning culture.

> *Hypothesis 1: Individuals in whom the interdependent self predominates will be more highly represented in a collectivistic subculture, whereas those in whom the independent self predominates will be more highly represented in an individualistic subculture.*

> *Hypothesis 2: Group performance loss, measured by the difference between the mean performance scores of individuals working alone and their scores working in groups, is less likely to occur in a collectivistic subculture, where the interdependent self is dominant, than in an individu-*

alistic subculture, where the independent self is more salient.

We also tested three hypotheses concerning group-based motivation.

Hypothesis 3: Social loafing occurs when group goals are set in general terms of "do your best" but not when group goals are specific and difficult.

Hypothesis 4: Social loafing is less likely to occur when team members can communicate with each other than when they cannot.

Hypothesis 5: Incentives for group goal attainment reinforce individual contributions to a group.

METHODS

Subjects

Two groups of midlevel managers participated in the study; 63 were from kibbutzim in Israel, and 59 were from urban areas. Participants in each sample had known each other for at least six months as trainees in a long-term managerial training program. We matched the urban individuals to comparable kibbutz individuals by gender, age, and education. Average ages were 41.7 years and 39.2 years for the kibbutz and urban samples, respectively. There were 59 men and 4 women in the kibbutz sample and 55 men and 4 women in the urban sample. The average level of education in the two samples ranged from higher education with a nonacademic degree to higher education with a bachelor's degree.

Culture

The kibbutz and the urban sectors represent two distinct subcultures in Israel. These two subcultures differ in their emphasis on collectivist and individualist values and in the practice of these values as shown in their principles of organization and conduct (Erez, 1986): A kibbutz is a communal settlement based on socialistic ideology and collectivist values. There is no private ownership and no differential reward system. All kibbutz members share the same facilities, including dining room, laundry, cars, medical care, and education. A few examples of the principles of the communal life of the kibbutz follow. (1) Production goals are communal rather than individual, decision making is communal rather than hierarchically centralized, and consumption is communal. Taken together, these features mean communally decided priorities governing the use of communal resources. (2) Equality in need fulfillment and in effort sharing is based on the Marxian principle, to each according to his or her needs from each according to his or her capabilities; this equality is coupled with dissociation between contributions and effort and between contributions and the distribution of rewards so that position and status do not determine material rewards. (3) Direct democracy is exercised by an organizational structure, which puts the highest authority concerning all kibbutz matters in the hands of the general meeting (usually convening once a week), in which every member has a vote. (4) Offices are rotated after predetermined periods of time ranging from one to five years, and there is a communal system of education and child rearing, whereby the community shares responsibility for the education of its members' children. (5) Each member has total life security in the domains of economics, health, and care of dependents, and the social structure depends solely on voluntary participation and cooperation for adherence to its norms and has no formal reinforcement mechanisms (Leviatan, 1984).

These unique characteristics of the kibbutz society create a subculture in Israel that is particularly distinct when contrasted with the urban sector. The two subcultures are significantly different on objective dimensions of structure, communal life, policies governing resource allocation, power distribution, and participation in decision making. In contrast to people in the kibbutz setting, individuals in the urban setting live their lives independently, mostly in family units. Each person or family has its own resources and is responsible for decisions concerning the creation and consumption of resources. Every citizen has the rights and duties defined by national and municipal laws. We expected these differences in sociocultural environment to promote psychological differences between the two sectors, with the interdependent self being more central to people in the kibbutz and the independent self more central to people in the cities. The differences in self-concept between the two sectors emerge over and above common characteristics derived from Israel as a collectivistic and egalitarian culture (Hofstede, 1991).

Design

The study consisted of a two-by-three-by-four (culture-by-goal-setting-condition-by-phase) partially crossed factorial design in which phase was a repeated factor. The kibbutz and the urban sectors represent the first factor. The second factor, goal-setting condition, had three categories: difficult individual goal, difficult group goal, and do-your-best goal. The level of goal difficulty was determined in a pretest conducted on another sample ($n = 32$). The individual goal was to evaluate at least 5 completed résumés of candidates for a production manager position in each phase. The group goal was to evaluate at least 15 résumés in each phase. The third factor consisted of four within-subject performance phases that represented different task conditions: phase 1 was an individual task and phase 2 was a team pooled task, wherein each member contributed to group output without needing to directly interact with other work group members (Saavedra et al., 1993). The comparison between phase 1 and phase 2 served to test the social loafing effect; phase 3, in which there was communication among group members, added to the previous task condition. Phase 4, which included economic incentives, again added to the previous condition. Each phase lasted seven minutes. In keeping with the social loafing literature, we chose a task for which performance was additive (conjunctive, in Steiner's [1972] terminology). That is, each individual's performance was added to the performance of other group members.

Task

As noted, subjects were asked to work on a simulated task requiring them to evaluate the suitability of candidates for a production manager position. Subjects read candidates' résumés and evaluated them on eight relevant criteria. Four sources of information were available for each candidate: (1) biographical data, (2) vocational experience, (3) general and specific ability, and (4) personality traits. Each member of a three-person group received partial information that consisted of biographical data plus two of the additional sources of information. The fourth source of information could be obtained from documented files that were presented to each team. In the last two performance phases, which permitted communication, this information was also available from other team members through personal communication, because each member of a three-person team lacked a different source of information. Subjects were asked to evaluate each résumé according to the eight criteria and to place a check on an evaluation form indicating whether or not the applicant met each of the criteria.

The level of task complexity was not high according to the criteria suggested by Wood (1986). The task did not require the processing of a great amount of information since there were only eight criteria for evaluating the applicants; it did not require a high level of coordination; and there was no change involved in the process.

Measures

Performance was measured as the number of criteria checked and completed by the subjects at each performance phase.

Goal commitment consisted of the mean response to three items based on Latham and colleagues (1988): (1) "To what extent do you agree with the goal that was set?" (2) "How important is it for you to at least attain the goal that was set?" (3) "To what extent will you strive to attain the goal that was set?" Each item was rated on a seven-point Likert-type scale ranging from 1, "strongly disagree," to 7, "strongly agree."

Independent and interdependent selves were measured by the Twenty Statement Test (TST) developed by McPartland and colleagues (1961). Instructions to subjects were as follows: "In the twenty blanks below please make twenty different statements in response to the simple question (addresses to yourself), 'Who am I?' Answer as if you are giving the answers to yourself, not to somebody else. Write your answers in the order they occur to you. Don't worry about the logic or importance. Go along fairly fast" (Cousins, 1989: 126). The measure has previously been used to depict cultural differences in self-definitions.

The independent self consists of personal qualities, attitudes, beliefs, and behaviors that do not relate to others (e.g., I am intelligent). The interdependent self refers to demographic categories or groups with which the subject is likely to be experiencing "common fate" (e.g., "I am a father of two kids"). Two judges content-analyzed the responses using the recommended coding scheme (Cousins, 1989; McPartland et al., 1961). Responses were coded as representing the independent self if they were self-referential and were classified into one of these four categories. (1) Physical: references to observable, physical attributes of self that do not imply social interaction (e.g., "tall"), (2) attributive: references to the self as a situation-free agent characterized by personal styles of acting, feeling, and thinking (e.g., "moody," "ambitious"), (3) personal aspirations: statements like "I aspire to get a doctoral degree", and (4) hobbies and preferred activities: statements like "I enjoy playing the piano," "I enjoy working in the garden."

Responses were classified as representing the interdependent self if they conveyed self-definition in relational terms, through references to others, and were classified into one of six categories: (1) family (e.g., "I am a mother"), (2) residency ("I am a kibbutz member"), (3) work or school affiliation ("I work in the guest house"), (4) military service ("I served in the airforce"), (5) political affiliation ("I am a member of the Labor Party"), and (6) human being ("I am a human being.").

Communication was also measured. Subjects filled out a form indicating, for each criterion that they evaluated, whether they got an additional information (1) by communicating with others or (2) by reading the files, or (3) got no additional information. The frequency of responses in the first category was the measurement of the amount of communication.

Ability, measured on the basis of individual task performance in a five-minute practice trial (see Procedures), served as a control variable.

Procedures

The procedures used for the kibbutz and urban samples were identical. An experimenter introduced herself to the trainees as a researcher interested in developing a training method for improving managers' performance in evaluating new job applicants. In both samples, subjects were randomly assigned to one of three goal-setting conditions: individual goal, group goal, and do-your-best goal. Subjects in the three goal conditions were instructed to seat themselves around tables in groups of three, and each group member received a set of instructions and a packet of evaluation forms and résumés that had to be evaluated. Subjects were asked to read the first set of instructions, which included a description of the position of production manager, the list of criteria for evaluation, and one résumé for practice. Subjects were given a five-minute individual practice trial to familiarize themselves with the evaluation task. The manipulation of the goal conditions was then introduced.

Phase 1: Individual performance. Subjects in both the individual and group goal conditions were assigned the specific, difficult individual goal, complete the scoring and evaluation of at least 5 résumés. Subjects in the third group were asked to do their best. Individual performance served as the basis for comparison with subsequent group performance.

Phase 2: Team performance. Every three subjects were instructed to form a team and were assigned goals according to the goal-setting condition. In the individual goal condition, each member of the team was given the goal of evaluating at least 5 résumés and asked to keep his or her completed résumés separate from others'. In the group goal condition, subjects were assigned a group goal of completing at least 15 résumés, and they were asked to put their completed résumés in one pile. In the third, do-your-best group, there were no specific goals, and subjects were asked to put their completed résumés in one pile. Subjects in all three goal conditions were allowed to use additional information from written files that contained complete information about all the job applicants. One set of files was available for each team. At this stage, subjects were not allowed to communicate with each other.

Phase 3: Team performance with intragroup communication. The instructions were the same as in the second phase, except that each team was encouraged to exchange information about the candidates. Each subject was instructed that other team members might have additional information about the applications that he or she was missing.

Phase 4: Incentive for performance. Subjects continued to work as in phase 3 but were rewarded according to their goal-setting conditions. Each person in the individual goal condition received a personal reward for achieving the individual goal of evaluating at least 5 résumés; each person in the group goal condition in a group that met the goal of evaluating at least 15 résumés also received a reward. In the do-your-best condition the reward was offered when a team completed 15 résumés, so in phase 4 this was no longer a general goal condition. The rewards were pens for subjects from the kibbutz sector and coupons for sandwiches for subjects in the urban sector. The two rewards were comparable in their value.

Subjects in the two specific goal conditions received a short questionnaire about goal commitment after goals were assigned in phases 1, 2, and 4.

RESULTS

The TST questionnaires were coded by two independent judges who were blind to subjects' sample membership (kibbutz versus urban). The judges classified each sentence as referring to either the independent or the interdependent self. The coefficient of reliability was .91. We calculated the response rate for each category as the ratio between the number of independent or interdependent responses and the total number of responses the subject made (the maximum number of responses possible for each subject or each category was 20). Table 1 shows the scores for independent and interdependent selves in the kibbutz and urban samples.

The results supported Hypothesis 1: Urban subjects obtained higher scores on the independent and lower scores on the interdependent self than kibbutz subjects ($t = 3.48$, $p < .001$).

TABLE 1
Means and Standard Deviations for Independent and Interdependent Selves

	Independent		Interdependent	
Statistic	Urban	Kibbutz	Urban	Kibbutz
Mean	0.78	0.62	0.22	0.38
s.d.	0.21	0.22	0.21	0.22
t	3.48***		3.48***	

*** $p < .001$

The following correlations (*r's*) between goal commitment and performance were found: phase 1, .20 ($p < .01$); phase 2, .26 ($p < .01$); phase 4, .37 ($p < .001$). All the correlations were positive and significant. The highest level of correlation was found in phase 4, when rewards for performance were offered. The results support previous research on goal setting indicating that goal commitment significantly affects performance (Erez & Zidon, 1984).

The mean frequencies with which subjects communicated with other group members and read the information files were as follows: Communication with other group members: for the urban sample in phase 3 the mean was 3.44 (s.d. = 2.84); in phase 4, the mean was 5.03 (s.d. = 4.35). For the kibbutz sample in phase 3 the mean was 4.54 (s.d. = 5.60); in phase 4, the mean was 7.35 (s.d. = 7.93). Reading the files: for the urban sample, in phase 3 the mean was 0.49 (s.d. = 1.34); in phase 4, the mean was 0.83 (s.d. = 3.13). For the kibbutz sample, in phase 3 the mean was 0.27 (s.d. = 1.01); in phase 4, the mean was 0.22 (s.d. = 0.59).

We analyzed the effects of culture, goal-setting condition, and experimental phase on performance scores by repeated-measures analyses of covariance (ANCOVA), using phase as the repeated factor and ability as the covariate. The homogeneity of the beta coefficients for the covariate was tested, and no significant differences were found between the groups.

Table 2 presents the mean performance scores, and Table 3 summarizes results of the analysis of covariance.

The results of the three-way ANCOVA demonstrated three main effects—culture, goal, and phase—as well as interaction effects ($p < .05$).

Subjects in the kibbutz sample outperformed subjects in the urban sample with ability controlled. Subjects in the do-your-best goal condition performed significantly more poorly than those with specific individual or group goals, but there were no significant differences between the two specific goal groups. Post hoc analyses of the difference between the four experimental phases showed that performance was significantly higher in the incentive phase (phase 4) than in all other three phases.

There were two significant two-way interactions (phase and sector, and phase and goal) and a three-way interaction between sector, goal, and phase.

TABLE 2
Performance by Experimental Conditions

Experimental Phase	Urban			Kibbutz		
	Individual Goal	Group Goal	Do-Your-Best Goal	Individual Goal	Group Goal	Do-Your-Best Goal
Phase 1						
n	25	19	15	21	22	20
Observed mean	25.25	23.56	13.90	26.90	30.17	20.55
s.d.	5.16	10.35	6.34	7.30	9.58	6.90
Adjusted mean	25.19	25.77	15.08	25.99	28.95	20.83
Phase 2						
Observed mean	25.41	20.87	11.00	28.50	28.58	19.05
s.d.	5.44	7.74	4.64	8.77	9.21	8.42
Adjusted mean	25.37	22.49	11.84	27.83	26.96	19.25
Phase 3						
Observed mean	25.25	27.50	18.49	27.80	30.41	16.35
s.d.	4.39	4.90	4.58	8.91	10.21	6.65
Adjusted mean	25.21	28.87	19.15	27.23	30.02	16.52
Phase 4						
Observed mean	32.95	33.37	27.85	35.30	40.52	29.10
s.d.	7.89	14.66	12.08	7.89	13.71	11.31
Adjusted mean	32.92	34.66	28.53	34.76	39.22	29.26

TABLE 3
Results of Three-Way Covariance Analyses of Performance

Source of Variance	Mean Square	*df*	*F*	*p*
Between				
Sector	2,062.93	1	7.63	0.001
Goal	2,896.93	2	10.72	0.001
Sector × goal	377.72	2	1.40	0.25
Ability[a]	6,433.21	1	23.80	0.001
Error	270.33	104		
Within				
Performance phases	1,187.83	3	24.43	0.001
Phase × sector	122.19	3	2.51	0.05
Phase × goal	104.89	6	2.16	0.05
Phase × sector × goal	119.48	6	2.46	0.02
Error	48.62	312		

[a] Ability was a covariate.

To better understand the pattern of the three-way interaction, we did separate analyses for the kibbutz and urban samples by using a two-way ANCOVA for each (see Table 4). Figure 1 presents graphs of the interaction effects in each sector.

Table 4 illustrates that there were significant main effects of goal and phase in the two sectors. However, the two-way interaction between phase and goal condition was significant in the urban sample only. We further interpret these findings in line with the research hypothesis concerning

TABLE 4
Results of Two-Way Covariance Analyses of Performance for the Kibbutz and Urban Samples

	Kibbutz				Urban			
Source of Variance	Mean Square	*df*	*F*	*p*	Mean Square	*df*	*F*	*p*
Between								
Goal	1,907.71	2	5.84	0.0068	1,633.55	2	10.02	0.001
Ability	1,974.52	1	6.04	0.0001	1,130.67	1	6.94	0.01
Error	326.67	59		0.25	162.94	50		
Within								
Performance phases	412.58	3	6.48	0.001	276.57	3	7.08	0.001
Phase × goal	41.21	6	0.65	0.69	83.98	6	2.15	0.05
Error	63.70	177	0.44	0.72	39.03	150	0.35	0.78

group performance. Hypothesis 2 proposes that group performance loss is less likely to occur in collectivistic than in individualistic subcultures, in particular when no goals, communication, and incentives on goal attainment are available. The three-way interaction between culture, goal, and phase supported Hypothesis 2. When we examined the interaction effect separately in the kibbutz and urban samples, as noted, we found that the two-way interaction between goal and phase was significant only in the urban sample. Urban subjects who were in the do-your-best goal condition performed significantly less well in phase 2 (group performance) than in phase 1 (individual performance; $p < .03$); no such differences were observed between phase 1 and phase 2 in the two specific goal conditions. In contrast, in the kibbutz sample, no significant differences in performance were found between phase 1 and phase 2, in all goal conditions.

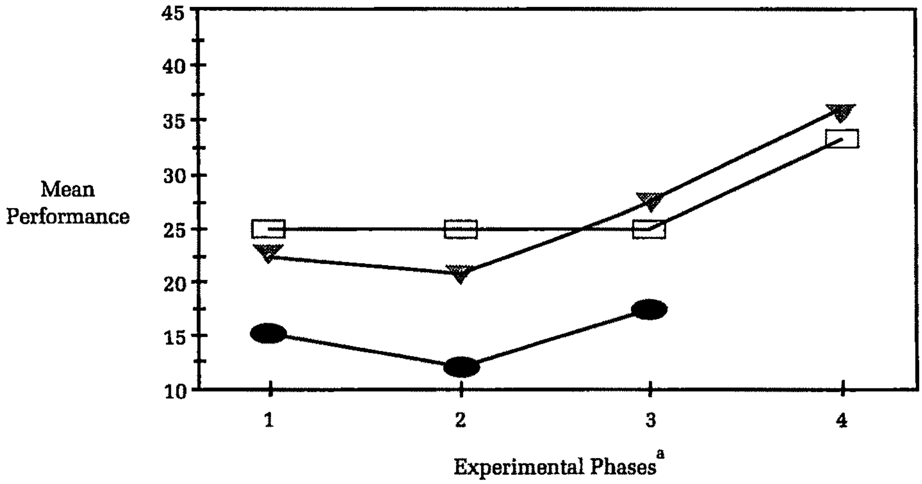
Hypothesis 3 proposes that social loafing occurs when group goals are general, but not when they are specific and difficult. We tested this effect by comparing phase 1 individual performance with phase 2 team performance across the culture subgroups. The results supported Hypothesis 3, revealing a significant main effect of goals and an interaction effect between goals and phase (see Table 3). The interaction effect showed that performance in phase 2 was significantly lower than in phase 1 only in the do-your-best condition. The presence of specific and difficult goals, whether individual or group, eliminated social loafing.

Hypothesis 4 proposes that social loafing is less likely to occur when team members communicate with each other than when communication is not possible. We tested this hypothesis by comparing phase 3, group communication, with phase 1, individual performance, and with phase 2, group performance with no communication.

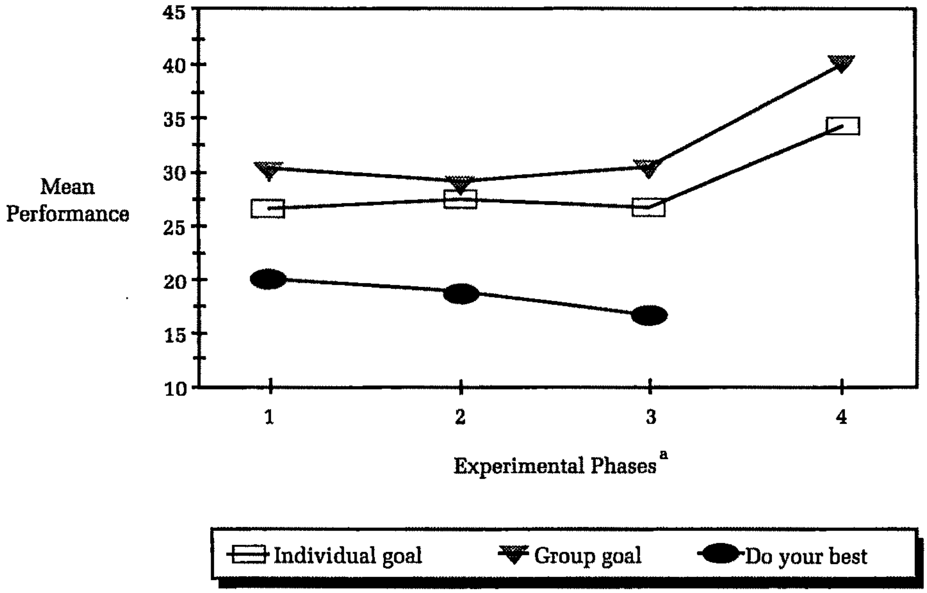
Table 3 shows that there was a significant effect of phase on performance, a significant two-way interaction of phase and goal, and a significant

FIGURE 1
Performance Means

(a) Urban sample



(b) Kibbutz sample



[a] Phase 1 is individual performance; phase 2, group performance; phase 3, group performance with communication; phase 4, performance incentives.

three-way interaction of phase, goal, and sector. We interpreted the three-way interaction by testing the ANCOVA's effects in the kibbutz and the urban samples separately. The results demonstrated that the two-way interaction effect of phase and goal was significant in the urban sample only. Post hoc analyses demonstrated that in the urban sample there were significant differences ($p < .05$) in performance between phase 3 and phase 2 in the do-your-best and in the group goal conditions, but not in the individual goal condition. In addition, there were significant effects between phase 3 and phase 1. These findings supported Hypothesis 3 in the urban sample only, where the communication in phase 3 helped overcome the social loafing seen in phase 2 for teams in both the do-your-best and group goal conditions.

Hypothesis 5 proposes that incentives for goal attainment reinforce individual contribution to a group. We tested this effect by comparing phase 4, in which there were incentives for performance, and phases 1 and 2, individual and group performance, respectively. The results supported Hypothesis 5 by demonstrating that the performance level achieved in phase 4 was significantly higher than that in phase 1 in both samples in the individual and group goal conditions ($p < .001$). It was also significantly higher than phase 2 performance in the two specific goal-setting conditions in both the kibbutz ($p < .01$) and the urban ($p < .10$) samples. It should be noted that in phase 4 there was no longer a do-your-best condition since subjects were rewarded for obtaining the goal set in the group goal condition. When incentives were introduced in phase 4, all subjects performed significantly better than in phase 2.

DISCUSSION

The question that stimulated the present study was whether social loafing, leading to group performance loss, is the rule or the exception. The answer to this question is important as more and more organizations shift from individual work to teamwork. The research on social loafing has led to the conclusion that it is a robust phenomenon that occurs when individuals work in groups. The research design in most previous studies has been similar, characterized by lack of real interactive groups. Subjects most often performed in pseudo groups, sometimes alone and sometimes with partitions between group members. Further, subjects were not allowed to communicate, and in most cases did not have specific goals or rewards for performance.

The present study examined group performance loss in 16 conditions representing four factors: with/without specific goals, with/without communication, with/without rewards, and with/without cultural values that support self-definition in relational terms and individual contribution to a group. In all of the experimental conditions the group members performed in the presence of others, and they had known each other for at least six months. Perhaps familiarity is important for team building. Social loafing was found in only 1 of the 16 conditions. Therefore, results demonstrate that social loafing is the exception rather than the rule.

This answer has both theoretical and practical implications. First, we identified conditions that mitigate social loafing: the presence of familiar others, the use of specific goals, intragroup communication, and incentives. The presence of others and interpersonal interaction adhere to the definition of groups (McGrath, 1984). Groups are intact social systems, and conceptual models of group effectiveness always involve process characteristics of interaction and communication (Goodman, 1990). Yet many studies of social loafing have missed these dimensions.

The individualistic subculture of the urban sector of Israel endorsed the independent self, which is less affected than the interdependent self by the presence of others and by the criterion of contributing to group performance. Therefore, in the absence of specific goals, communication, and incentives, the urban groups experienced performance loss. In contrast, members of the collectivistic subculture, whose individual contribution to their groups enhanced their interdependent selves, contributed to group performance even in the absence of specific goals.

The Effect of Specific Group Goals

The positive effect of specific group goals on group performance provided additional support for the existing goal-setting research literature (Locke & Latham, 1990; Weldon et al., 1991; Weldon & Weingart, 1993). The design of our study allowed for testing the effect of specific goals, which provided clear standards for evaluation, against the effects of do-your-best goals, which did not provide such clear standards. The results demonstrated that subjects who lacked standards for evaluation performed significantly more poorly than subjects in the two specific goal conditions. In addition, we observed group productivity loss only for those in the do-your-best condition; no performance loss was observed in the specific group goal condition even when individual contributions could not be identified. Performance evaluation according to standards seems to be more important to group performance than the prospect of identifying individual contribution to group performance.

The positive effect of specific goals on group performance can also be explained by the expectancy model. Specific goals establish the link between performance and outcomes. They provide opportunities for developing high expectations, which motivate behavior (Shepperd, 1993). In addition, the valence of obtaining difficult goals makes a task more meaningful (George, 1992; Locke & Latham, 1990). Therefore, the setting of specific and difficult goals enhances the motivational force for goal attainment.

Intragroup Communication

As noted, most research on social loafing has examined the performance of groups in which interaction is low: group members often do not know each other, they have no direct contact, and they are not allowed to communicate with one another. These groups do not quite fit the definition of groups as social aggregates that involve mutual awareness and potential mutual interaction

(McGrath, 1984), because both were minimized. The present study, in which communication enhanced mutual awareness and interaction among group members, provided further support to the positive effect of communication on enhancing cooperation and performance (Chen & Komorita, 1994; Wagner, 1995). The subjects in our study knew each other prior to the experiment; they were sitting together as a group, had direct contact with each other, and were allowed to communicate on work-related issues in the third phase of the experiment. Intragroup communication assured awareness of the presence of others and facilitated evaluation apprehension. The present findings demonstrated that in the urban sample, performance in the do-your-best goal condition significantly increased in phase 3.

Communication with others increased evaluation apprehension. Communication did not affect performance in the individual goal condition because performance standards existed anyway, and potential evaluation by others, which was relevant for subjects in the group goal condition, became less relevant for subjects with individual goals. The finding suggests that the mere presence of others (in phase 2) was not enough to overcome social loafing, which decreased with the introduction of communication, which enhanced evaluation apprehension (Geen, 1991).

The kibbutz members did not improve their group performance in the communication phase. Rather, under the do-your-best goal their performance in phase 3 was marginally lower than that in phases 1 and 2. One possible explanation is that kibbutz members are used to interpersonal communication, and therefore they were less sensitive to its effect than the urban Israelis were (Erez & Earley, 1993: 168). A second possible explanation is based on observations we made during the experiment: Kibbutz members took advantage of the communication phase to pursue "off-task" communication, including small talk. Therefore, when they did not have specific goals to direct their effort in the do-your-best condition, they were marginally less productive than they had been in phase 1, which served for comparison. Off-task communication was not observed in the urban sample.

Incentives

The effect of incentives on performance has long been recognized. According to goal-setting theory, incentives increase the level of goal commitment. In the present study, incentives led to the highest level of correlation between commitment and performance ($r = .37$). According to expectancy theory, incentives enhance the level of motivation because they increase the valence of performance outcomes and strengthen the link between performance and outcomes. Hence, incentives could remedy group performance loss by increasing the valence associated with achieving group goals (Shepperd, 1993). In addition, incentives associated with goal attainment activate the process of evaluation, which facilitates group performance. The results of the present study support all three theories of motivation—goal-setting, expectancy, and social facilitation—as incentives significantly increased the level of performance. The highest level of performance was obtained in phase 4, the specific group goal condition, in the kibbutz sample. One possible explanation is that group incentives magnify the value associated with the attainment of group goals and thereby enhance the level of motivation. A second explanation is that the kibbutz members were more experienced in teamwork, and they valued it more highly than the urban people. Therefore, they had an advantage over the urban teams when they were all motivated to win the rewards.

Culture: The Interdependent versus the Independent Self

The present findings demonstrated, in line with our hypothesis, that the interdependent self was more prevalent in the subjects from kibbutzim, which are highly collectivistic and egalitarian societies by definition. The independent self was more prevalent among people from the urban sector, which differs from kibbutzim in being more individualistic (Erez, 1986; Leviatan, 1984). The Twenty Statement Test allows individuals to freely express their self-concept, and it captured the cultural variation between the kibbutz and urban sectors.

The model of cultural self-representation (Erez & Earley, 1993) served as our basis for interpreting the moderating effect of culture on the effectiveness of group goals, intragroup communication, and incentives. Contributing to the attainment of group goals is more highly valued by the interdependent self, which is also more sensitive to evaluations made by significant others and hence more susceptible to the effect of social facilitation than is the independent self. Therefore, the interdependent self positively evaluates contribution to group performance, which leads to a high level of performance, even in the absence of specific group goals. On the other hand, contribution to the collective does not enhance the independent self, and therefore, productivity loss occurred in the urban sample when no specific goals were set. The present study supports previous research on the moderating effect of culture on social loafing (Earley, 1989, 1993). However, this study focuses on the representation of cultural values in the interdependent and independent selves.

Culture moderated the effect of intragroup communication on group performance in the do-your-best condition. Intragroup communication increased awareness of the presence of others as potential evaluators. As a result, group performance significantly increased. However, intragroup communication did not improve performance in the kibbutz sample. As we have already suggested, kibbutz members are used to the presence of others, and therefore they were less sensitive to the change from no-communication to intragroup communication (Erez & Earley, 1993). In addition, they took the opportunity to communicate about issues other than the task and did not allocate all their resources to performing the task when no specific goals were set.

Finally, culture seemed to moderate the effect of group incentives on performance. The highest level of performance was attained by kibbutz members in the group goal condition, when goal attainment was accompanied by incentives. It may suggest that group incentives increase the valence of contribution to group goals, which is highly valued by the interdependent self. The effect of group incentives was somewhat weaker in the urban sample because the independent self does not appreciate contribution to group goals as much as the interdependent self does.

Implications for International Management

There is a growing emphasis on teamwork in organizations. Therefore, it is important to identify the conditions that minimize group productivity loss. This study identified the following conditions. First, when team members are familiar with each other, and when they work in the presence of each other, they are less likely to loaf than they are when they work in pseudo groups or in newly formed groups. Second, setting specific, moderate-to-difficult goals overcomes group productivity loss. Goals provide standards for evaluation, direct a group toward goal attainment, establish the link between performance and outcomes, and, when difficult goals are set, increase the valence of goal attainment.

Third, communication among group members reduces social loafing. This effect can be achieved when group members get to know one another, when they have direct contact, and when they can communicate with each other. Our findings suggest that in the absence of specific goals, members of collectivistic cultures use channels of communication for processing off-task information, and consequently, they reduce the attention allocated to task performance. Thus, it is important to set specific and difficult goals and to provide feedback on performance in order to focus attention on task performance.

Fourth, performance-based incentives should be considered as potential motivators. Incentives establish standards for evaluation, and they increase the valence associated with goal accomplishment. Group incentives motivate members of collectivistic cultures because they strengthen the valence associated with contribution to the collective.

The present findings imply that group performance loss is the exception rather than the rule. Teamwork in individualistic cultures can be highly effective if implemented correctly. Team productivity is enhanced when team members are familiar with each other, when they interact with each other to promote mutual awareness and understanding, knowledge sharing, and coordination, and when their behavior is guided by specific group goals that are followed by feedback and incentives for goal accomplishment. One example is the implementation of quality improvement teams. Such teams were first implemented in Japan, a collectivist culture, with which the focus on team performance is consistent. However, quality improvement teams have also been implemented in individualistic cultures such as the United States and Great Britain. Companies like Motorola and Xerox, both of which won the Baldrige National Award for quality, have restructured their organizations and developed human resource management practices to support teamwork. Individual jobs were often transformed into functions of ad hoc or permanent cross-functional teams, which increase people's interdependence and need to function together rather than independently. Cooperation and collective responsibility are further enhanced by shifting the focus from the job to the organization. All of the companies that have won the Baldrige Award integrate rewards based on the individual and team levels. At Xerox, individuals are nominated for the President's Award or the Xerox Achievement Award. Teams compete for the Excellence Award and the Excellence in Customer Satisfaction Award. Motorola sponsors a Team Quality Olympics in which teams make formal presentations of their contributions and receive gold, silver, or bronze medals accordingly. Westinghouse has implemented peer review for determining quality achievement winners. Incentives on the corporate level, including profit sharing, gain sharing, and employee stock ownership plans, support the shift of focus from the individual to the organizational level. Combining team focus with individual focus and rewarding individual contributions to team efforts are effective ways for implementing teamwork in individualistic cultures and for overcoming group productivity loss (Blackburn & Rosen, 1993; Earley & Erez, 1996).

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DEVELOPMENT OF LEADER-MEMBER EXCHANGE: A LONGITUDINAL TEST

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This longitudinal study examines the development of leader-member-exchange (LMX) relationships via a model that extends and tests ideas presented but not yet fully tested in past theoretical models. New subordinates ($n = 205$) and their supervisors ($n = 112$) provided data that were used to test hypotheses stating that dyadic gender and personality similarity, member performance, and leader delegation would be incrementally and cumulatively related to LMX development. Support was found for relationships between the quality of leader-member exchange and positive affectivity similarity, performance, and delegation, but not for a relationship with gender similarity. In addition, it appears that good member performance may precede leader delegation.

Over 20 years ago, vertical dyad linkage (VDL) theory was presented by Graen and his colleagues (e.g., Dansereau, Graen, & Haga, 1975). Since then, this theory has evolved into a dyadic approach to understanding supervisor-subordinate working relationships known as leader-member-exchange (LMX) theory. The dyad consists of a leader—usually a supervisor—and an organization member, usually a subordinate (Graen & Scandura, 1987). The theoretical basis of LMX is that dyadic relationships and work roles are developed or negotiated over time through a series of exchanges, or "interacts," between leader and member. It is argued that early in the relationship-building process, factors other than behavior affect how the relationship develops (Dienesch & Liden, 1986). Through their behavior, each member of the dyad invests resources in the development of the relationship. For example, the leader may offer increased job latitude or delegation to the member, and the member may offer strong commitment to work goals or high levels of effort and performance to the leader (Dienesch & Liden, 1986; Liden & Graen, 1980; Scandura & Graen, 1984).

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Consequently, a manager with ten subordinates will have ten distinct leader-member-exchange relationships. Because the time and resources of both parties are limited (Green, Anderson, & Shivers, 1996) some of these relationships will evolve into high-quality exchanges typified by high levels of mutual trust and respect, and others will be of lower quality and based primarily on the formal employment contract. A key component in building a high-quality leader-member exchange appears to be the development of interpersonal trust within the leader-member relationship that goes beyond the formal employment contract (Dienesch & Liden, 1986). Thus, it follows that a key aspect of LMX development must be factors that would theoretically be linked to trust building within the leader-member relationship. High-quality leader-member-exchange relationships are seen as evidence of successful trust building over time. This study will help to unravel prediction of the quality of exchanges that develop in newly formed dyads by examining a set of variables that could be expected to contribute to trust and leader-member-exchange building over time. But first, it is important to trace some of the history of LMX research.

Research shows that leader-member exchange is related to important organizational outcomes such as subordinate turnover (Graen, Liden, & Hoel, 1982), subordinate satisfaction (Graen, Novak, & Sommerkamp, 1982; Graen, Orris, & Johnson, 1973; Scandura & Graen, 1984), promotions (Wakabayashi, Graen, Graen, & Graen, 1988), ratings of member performance (Graen et al., 1982; Liden & Graen, 1980; Scandura & Graen, 1984), and member extra-role performance (Wayne & Green, 1993). Even though many studies of the outcomes of leader-member exchange have been conducted, large strides toward understanding its development have not been made. And although two often-cited models of leader-member-exchange development have been presented (Dienesch & Liden, 1986; Graen & Scandura, 1987), almost a decade later no formal test of these models has been undertaken.

Dienesch and Liden stated that "it is not known what takes place between a leader and subordinate that results in a particular type of exchange" (1986: 626). Since publication of that statement, a body of work has begun to address the issue of LMX development, or the idea of the quality of leader-member exchange as a dependent variable (e.g., Dockery & Steiner, 1990; Duchon, Green, & Taber, 1986; Liden, Wayne, & Stilwell, 1993; Wakabayashi et al., 1988; Wayne & Ferris, 1990). It is still somewhat unclear, however, how or why relational characteristics, performance, and delegation contribute over time to the formation of LMX relationships.

The purpose of this study was to fill four identified gaps in the literature while drawing upon the LMX and trust literatures. First, we focus on the role of delegation-performance interacts over time as a significant part of that trust-building process. Previous theory describes such interacts as a "reciprocal response pattern" (Graen & Scandura, 1987) or a set of "interlocked" behaviors (Weick, 1979). We tried to better understand these exchanges by examining several issues, such as the influence of individual differences on the components of an interact and how those components relate over time.

Second, we provide the first test of delegation as an important leader behavior, viewing delegation as a key part of evaluations of trust and role taking during leader-member-exchange development. Only two other published studies could be found that addressed delegation and LMX (Scandura, Graen, & Novak, 1986; Schriesheim, Neider, Scandura & Tepper, 1992). Scandura and colleagues (1986) studied delegation as part of a larger construct by looking at the decision influence granted to subordinates and its relationship to their performance and the quality of leader-member exchange. Interactions between exchange quality and subordinate performance were interpreted as indicating that either LMX or good performance was associated with higher decision influence for subordinates. Although these findings are consistent with arguments made here, Scandura and colleagues did not measure delegation as a separate construct (because it was not a specific focus), and the lack of a longitudinal design obscured the direction of the relationships between leader-member exchange and delegation. Schriesheim and coauthors (1992) found that in dyads characterized as having high-quality leader-member exchange, supervisors' decision making was typically less autocratic and more delegative than that of supervisors in lower-quality dyads. Both of these studies, however, investigated established leader-member dyads rather than newly formed ones. In the present study, we focused on delegation as a critical part of the LMX development process and examined it within a longitudinal design.

Third, we further extend previous theory by drawing on bodies of research on trust, relational demography, and affectivity while proposing similarity in leaders' and members' gender and positive affectivity as potentially influential precursors of leader-member-exchange development. We link LMX research to work being conducted on affectivity (e.g., Judge, 1992) and on relational characteristics (e.g., Tsui & O'Reilly, 1989) by proposing that similarity on these variables will be a precursor of LMX quality. Only one other field study of personality and LMX development could be found (Phillips & Bedeian, 1994). The overarching interpretation of LMX development as significantly influenced by trust building guided our choice of variables measuring relational demography and affectivity, which we saw as early influences that could shape the conditions for engaging in dyadic trust building over time.

Finally, the cumulative effects of gender and personality similarity as well as delegation and performance are predicted to be related to trust building and ultimately to the quality of leader-member exchange that develops. This work addresses leader-member-exchange development over time, a notion addressed in previous models but never fully developed. From the previous models, it is unclear exactly how LMX relationships form and change over time and how early episodes in relationship development are related to later episodes. In this study, we propose that performance and delegation are related to each other within and across time periods. Moreover, drawing on the socialization literature, we argue that quality of leader-member exchange is the result of cumulative effects of a developmental process. So, in summary, the present study builds on previous work by proposing and testing a model that builds on past theorizing on leader-member exchange (e.g., Dienesch & Liden, 1986; Graen & Scandura, 1987) and trust (e.g., Lewis & Weigert, 1985; Mayer, Davis, & Schoorman, 1995).

MODEL OVERVIEW

A few points should be noted before the predicted model is described. Methodologically, as well as theoretically, new organization members are especially desirable to study because they are new to both their organizations and relationships (Dienesch & Liden, 1986). Further, because leader-member exchange is dyadic, we collected data from both sides of dyads. Since LMX formation is a temporal phenomenon, we tested the proposed model at three points in time, collecting the first data prior to member entry into the organization.

According to both Dienesch and Liden's model and our own, early in relationships dyad characteristics should matter, but over time, exchange of resources and testing of competence will be more influential than similarity. Thus, similarity and behavior are not mutually exclusive but rather two components of the relationship development process.

This study is not the first to discuss trust as integral to the leader-member-exchange formation process. In general, there is agreement that leader-member exchange is intertwined with the concept of mutual trust. For example, Dienesch and Liden (1986) proposed that trust and loyalty are critical to leader-member exchange and the development process, and Graen and Uhl-Bien (1995) argued that LMX is composed of the interrelated dimensions of respect, trust, and obligations. As these theorists have stated, early in relationship formation, the superior needs to have confidence in the ability and willingness of the subordinate to successfully complete tasks. Further, the subordinate needs to be confident that he or she will receive desired resources from the leader in exchange for commitments. If this trust is established, both parties can be more assured of benefiting from continuing the development of the relationship (Dienesch & Liden, 1986).

Given the uncertainty and complexity inherent in managerial work, trust is essential (McAllister, 1995). In their theoretical article, Lewis and Weigert (1985) proposed three levels of trust: The cognitive level consists of evaluating trustworthiness. The behavioral level involves taking the risk of acting on perceptions of trust. The affective level involves the emotional bond that forms between dyad members over time. These components are closely aligned with models of leader-member-exchange development as having three phases: role taking, when members are evaluated; role making, when member performance and leader delegation interacts begin to formalize relationships; and role routinization, when LMX relationships become affect-laden (Graen & Scandura, 1987).

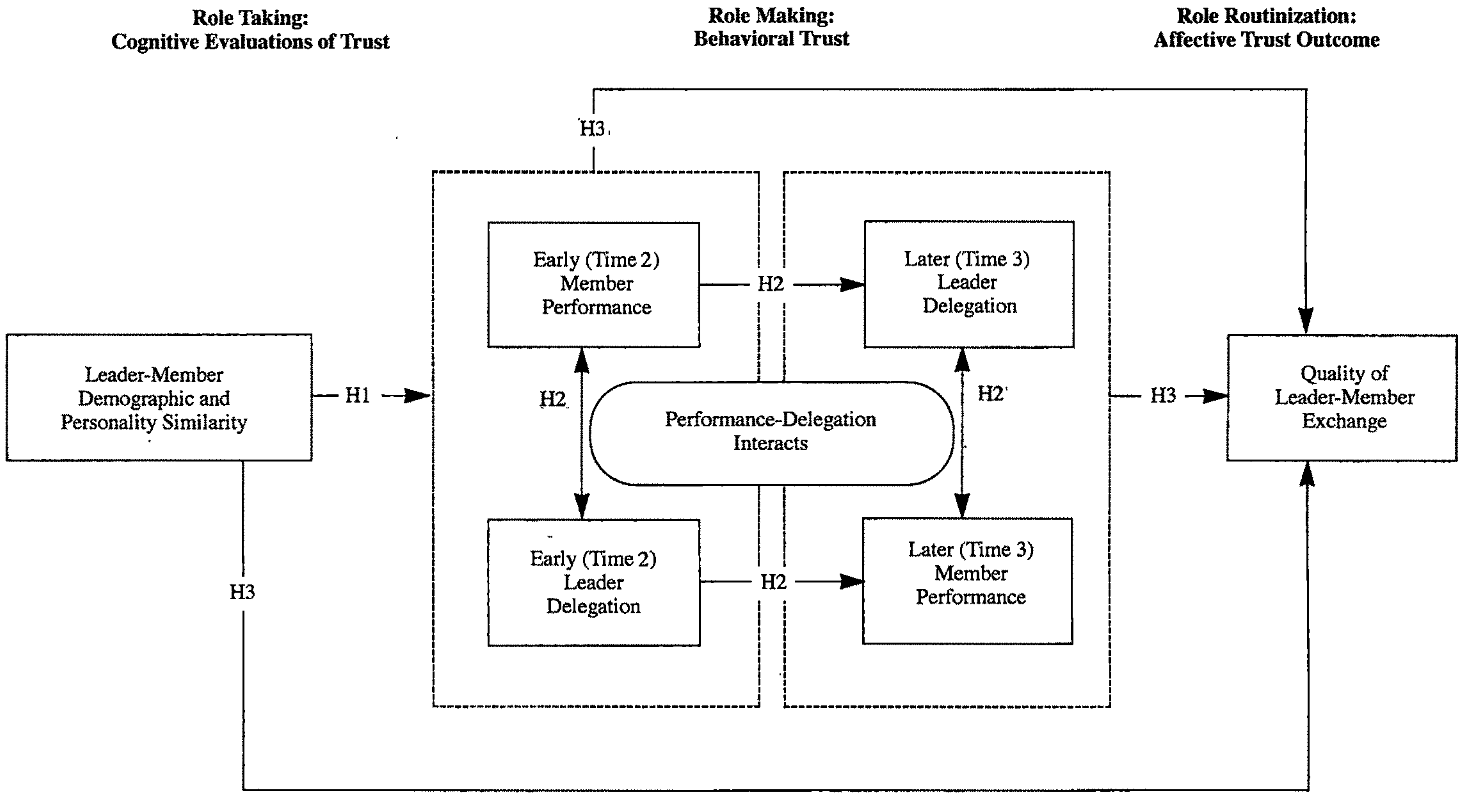
McAllister (1995) empirically found that for 194 workplace dyadic peer relationships, cognition-based trust preceded affect-based trust. This observation lends further support to our proposed model of leader-member-exchange development, in which evaluation of performance (role taking) is seen as preceding the later LMX relationship, which is an affective trust outcome. Mayer and colleagues (1995) also developed a model of trust that is consistent with the model proposed here; they posited that people use certain factors, such as ability and performance, to help determine another's trustworthiness. Perceived risk and risk taking then take place, and outcomes of the trusting behavior will ensue. Again, these three stages closely parallel the three stages proposed in our model (Figure 1). Given the wide acceptance of trust as an important aspect of leader-member exchange and the parallels between the trust and LMX literatures, it made sense to draw upon the former as a theoretical basis for our predictions.

Thus, the model begins with leader and member characteristics expected to influence both a leader's summary judgments of a member's early performance and how the leader behaves toward the member in terms of delegation. Influences on perceptions of trust will play a large part in the leader's decision about delegating to the member. For example, perceived competence and responsibility are central to the development of trust (McAllister, 1995) as well as of leader-member exchange (Dienesch & Liden, 1986). We thus depict member performance and leader delegation as reciprocal influence interacts; the amount of delegation and the leader's perceptions of member performance tend to reinforce each other. Good performance is followed by more delegation and vice versa. Of course, an opposite pattern could develop, with delegation followed by poor performance, which in turn leads to less delegation. Over time, these performance-delegation interacts are expected to develop into patterns that will ultimately influence the trust levels in the relationship as seen in the quality of exchange that develops between leader and member. The summary model to be tested, however, contains no predictions of causality within single time periods, in which reciprocal effects cannot be disentangled. Causal predictions are made, however, across time periods.

Role Taking and Cognitive Evaluations of Trust

Theorists (e.g., Dienesch & Liden, 1986; Mayer et al., 1995) have proposed that leader and member characteristics will influence initial interactions between a leader and a member. For example, both members of a dyad bring unique demographic characteristics and personalities to the relationship. Early in the relationship, when the leader and member have limited information about one another, these characteristics will be salient and set

FIGURE 1
Model of Leader-Member-Exchange Development


Role Taking:
Cognitive Evaluations of Trust
Role Making:
Behavioral Trust
Role Routinization:
Affective Trust Outcome
Leader-Member Demographic and Personality Similarity
H1
H3
Early (Time 2) Member Performance
Early (Time 2) Leader Delegation
H2
Performance-Delegation Interacts
Later (Time 3) Leader Delegation
Later (Time 3) Member Performance
H2
H2
H2'
H3
Quality of Leader-Member Exchange

the stage for later interactions. As time goes on, however, leaders may begin to evaluate and test new members rather than simply relying on stereotypes and biases (Dienesch & Liden, 1986). This stage of the relationship corresponds to the role-taking phase in Graen and Scandura's model as well as to the early formation of cognitive evaluations of trust in Lewis and Weigert's (1985) model. According to Graen and Scandura's (1987) three-phase model of role taking, role making, and role routinization, the initial role-taking phase is really a sampling phase in which a leader evaluates the behavior and motivation of a member to decide how much time and energy to invest in the member in the future. The leader evaluates the behavior, often performance, and then makes a decision regarding responses to the member. In this phase, job latitude is a key resource exchanged for member resources. This phase can last anywhere from a few hours to a few months (Graen & Scandura, 1987).

Following LMX and trust theorists, we propose that leader and member characteristics are important determinants of leader-member-exchange development through their influence on early member performance and leader delegation interacts. Demographic and personality similarities are proposed to increase affect and attraction (Meglino, Ravlin, & Adkins, 1989) and trust (Mayer et al., 1995), which in turn should influence perceptions of performance and the leader's tendency to delegate. These predictions are more fully developed in the following sections.

Relational dyadic characteristics and leader delegation. Delegation can be a vital part of a manager's job. As Scandura and colleagues (1986) pointed out, decisions can range from being completely autocratic to completely delegated. At times, the limits of time and energy make delegation an attractive alternative to doing all one's work alone and to making every decision alone. Delegation involves risk, however, and is not always the most efficient way to get things done (Yukl, 1994). It is likely that to decrease that risk, managers will delegate when subordinates have characteristics that promote trust. Similarity may be such a characteristic (Mayer et al., 1995; Rosen & Jerdee, 1977). Dienesch and Liden (1986) proposed that leaders may test their early perceptions by offering delegation (cf. Kruglanski, 1970).

Gender was chosen for study here because it has been shown to specifically predict out-group status in studies of superior-subordinate dyads (e.g., Duchon et al., 1986). Simple demographic characteristics do not seem to predict leader-member exchange, but relational demography—the extent to which individuals are similar—may (Gerstner & Day, 1995). For example, in their comprehensive study of relational demography, Tsui and O'Reilly (1989) found gender similarity to be the best predictor of member performance. Further, researchers who have not included gender similarity as a relational demography variable have often stated that it was omitted only because of little or no gender variation in a sample (e.g., Ferris, Judge, Rowland, & Fitzgibbons, 1994; Turban & Jones, 1988). Therefore, we considered gender similarity a powerful potential predictor of trust and leader-member exchange.

In addition, when dyad members have similar outlooks owing to similar personalities, leaders may be inclined to view members' performance more positively, to trust them more, and to delegate more to them. In her study of delegation behavior, Leana (1986) found that supervisor personality was not related to delegation. We predict that relational personality, or personality similarity, is a more appropriate focus and will make a difference. As was argued, the more similar the dyad is, the more trust and understanding should develop. In fact, Turban and Jones (1988) found that subordinates who perceived their supervisors as similar to themselves reported greater degrees of trust and confidence in their leaders. It follows that these feelings will be reciprocated and that part of the role-taking phase will involve greater delegation to subordinates who have the potential to evolve into in-group members. This pattern seems especially likely to occur because (1) trust takes the place of direct supervision and frees supervisors to attend to other matters (Mayer et al., 1995) and (2) trust takes less energy than distrust (Barber, 1983).

Positive affectivity, which we chose as the personality variable of interest, represents an individual's disposition to feel enthusiastic, active, and alert (Watson, Clark, & Tellegen, 1988). This personality characteristic was chosen for four reasons. First, although many personality variables predicting job attitudes and behavior have yielded disappointing, nonpredictive results in the past, studies using affectivity have proved much more fruitful (see Judge [1992] for a review). Second, Gerstner and Day (1995) suggested that additional research investigating robust dispositional characteristics that may be associated with LMX development needs to be done before researchers can truly understand the role that personality plays in this process. Affective disposition can become evident early in the relationship and therefore is fairly salient. Third, no study to date has investigated the impact of affectivity or affectivity similarity on leader-member exchange, so this study was an opportunity to explore that relationship. In their study of personality and leader-member exchange, Phillips and Bedeian (1994) found support for a relationship between exchange quality and extraversion, which is very similar to positive affectivity (Block, 1995). Fourth, Kurdek (1993) found that extraversion dissimilarity, along with other personality dimensions, predicted the eventual dissolution of newlywed couples. Although this study focuses on a very different type of dyad, those results have implications for the present study, since marriage is also an exchange relationship.

It is difference or similarity that is of interest here, rather than whether either dyad member is high or low on positive affectivity. Enthusiastic, energetic people should want to be around other enthusiastic, energetic people, and view them more favorably than those who differ from themselves. Dissimilarity in affectivity might well lead to differences of opinion about the work context that could create social distance between leader and member, lower trust, and increase misunderstandings. Misunderstandings on either side of the leader-member relationship can lower its quality, which is a mutually negotiated outcome.

Relational dyadic characteristics and member performance. Liden and colleagues (1993) noted that when processing performance evaluation information, individuals may assign a different set of characteristics to someone who is similar to them than to someone who is dissimilar to them on the basis of categorizations rather than actual observations. This tendency may be especially pronounced early on, when performance ratings are based on relatively little information (Dienesch & Liden, 1986). Supervisors may rate individuals they see as similar more favorably on performance dimensions, or perhaps the supervisors enhance the ratees' performance through increased support and encouragement.

Several mechanisms may be working together to create this effect (Turban & Jones, 1988). The first mechanism is that similarity may enhance behavioral predictability (Meglino et al., 1991). This predictability would allow two individuals to anticipate each other and increase the ease and quality of their interactions. The second mechanism is similar interpretations of events and a common system of communication (Schein, 1985). Johnson-George and Swap (1982) found that men and women differ in what information they use in developing trust in others. Further, Kurdek (1993) noted that partners with large discrepancies on individual difference scores may have difficulties because they appraise events that take place within the relationship from incompatible vantage points. Another potential mechanism is supervisors' seeing similar subordinates having high potential because they are like themselves. Theoretically, these mechanisms are an important part of the leader-member-exchange development process because they can contribute to a growing sense of trust in the relationship (Dienesch & Liden, 1986), and they make for more stable interpersonal relationships in general (Blau, 1964; Lewis & Weigert, 1985). Initial impressions of a subordinate's behavioral predictability and similar cognitive style are expected to increase the likelihood that a leader will initiate performance-delegation interacts.

Past models of performance evaluation decisions have supported the positive influence of supervisor-subordinate demographic similarity via affect or perceived similarity. Studies of dyadic demographic similarity have investigated age and tenure (Ferris et al., 1994; Judge & Ferris, 1993; Tsui & O'Reilly, 1989; Turban & Jones, 1988), race and education (Ferris et al., 1994; Tsui & O'Reilly, 1989; Turban & Jones, 1988), and gender (e.g., Tsui & O'Reilly, 1989; Wayne & Liden, 1995). It is unclear whether these findings represent rater error (i.e., halo error) or true differences in performance between similar and dissimilar ratees. What is clear, however, is that similarity is related to higher performance ratings. The bottom line seems to be that individuals tend to like (Tsui & O'Reilly, 1989) and trust (Mayer et al., 1995) people who are similar to themselves, and it has been suggested that affect (e.g., DeNisi & Williams, 1988) and trust (Turban & Jones, 1988) may influence the processing of performance information.

In regards to personality and leader-member exchange, Phillips and Bedeian (1994) found that leaders' perceptions of leader-follower attitude similarity were related to exchange quality, but Liden and colleagues (1993) found no such relationship. In Phillips and Bedeian's (1994) results, one member personality characteristic, extraversion, was related to exchange quality, but two others—locus of control and growth need strength—were not. Although their study did measure follower personality characteristics, it did not examine follower-leader personality similarity nor examine personality in the context of performance and delegation interactions over time. Other studies of personality, however, have suggested that relational personality does influence dyadic outcomes such as marital success (e.g., Kurdek, 1993) and that similar dyad-member work values are related to job satisfaction and organizational commitment (e.g., Meglino et al., 1989). So, taking relational characteristics a step further in the context of leader-member-exchange development research, we examined personality similarity in this study.

> *Hypothesis 1: Similarity between a leader and a member in gender and positive affectivity will be positively related to member performance ratings and leader delegation.*

Role Making and Behavioral Trust

Role making is a continuation of the developmental process in which further exchanges are made. Graen and Uhl-Bien (1995) called this the acquaintance stage. If a dyad is developing a high-quality exchange relationship, the exchange becomes more social and less quid pro quo (Graen & Uhl-Bien, 1995). At this point, one of the member's greatest assets will probably still be good performance. Conversely, if the relationship is not evolving to the next level, the relationship will remain based on the employment contract. This is the stage at which behavioral aspects of trust come into play. The leader is taking a risk by delegating work to the member. The leader might have thought before that he or she trusted the member, but it is not until this stage that these cognitions are put into action (Lewis & Weigert, 1985).

Performance-delegation interacts. Mayer and colleagues (1995) noted that in an increasingly diverse workforce, in which interpersonal similarity is lessening, the development of trust enables employees to work together more effectively. Thus, although early in relationship development, salient factors such as gender and personality may influence the role-taking process and increase the chances for trust to emerge, it is vital that judgments of competence, loyalty, and consistency be tested within the work context as well.

As noted earlier, member performance and delegation have been depicted as combining in interacts that are integral parts of role making (Dienesch & Liden, 1986; Graen & Scandura, 1987). As a relationship develops, dyadic trust deepens or lessens. Thus, in Figure 1, we propose that delegation is reflexive with leader judgments about member performance. This concept of an interact dates back to Weick's (1979) early work on the social psychology of organizing. There, he argued that the interlocked behavior of two people is the fundamental unit of organizing. Graen and Scandura (1987) subsequently invoked this concept, in describing the development of leader-member exchange, where leader and member behavior are contingent upon each other. Communication theorists also have also adopted and expanded the concept of the interact as a basic unit in communication and relationships (Hawes, 1973). Moreover, the examination of interacts has been argued to be a fundamental approach to understanding relationships between two people (cf. Fairhurst, Rogers, & Sarr, 1987). The underlying notion of the interact is that the action of one person and then the reaction of the other person reveal the nature of their relationship. Understanding these interacts in a micro sense is complicated by the fact that a reaction becomes the action that initiates the next interact. Thus, in communications research, relationships are studied by examining chains of interacts during communication.

As argued earlier, delegation and member performance appear to form one of the important types of interacts that contribute to and eventually define the quality of exchange in a leadership relationship. Previous research indicates that delegation requires trust and perceptions of competence on the part of a leader (Yukl, 1994), because delegation always involves risk for that individual (Mayer et al., 1995). Similarly, delegation provides a member with increased job challenge and autonomy; these may motivate the member to perform better than before and certainly are an opportunity for the member to distinguish him- or herself through good performance. This formulation is consistent with the findings of Schriesheim, Scandura, and Neider (1991), who found performance and delegation to be significantly and positively related. Taking this perspective suggests several hypotheses. First, if performance and delegation are a form of interact, then they should be related to each other at any given point in time. Better performance should provoke more delegation, which leads to more delegation that offers the opportunity for better performance, and so on. Also, given that interacts tend to exist within chains of behavior, one would expect an interact at one point in time to be related to interacts that occur later; for instance, early performance judgments should be related to later delegation. The idea of interacts is consistent with findings in the trust literature showing that the best predictor of a supervisor's trust in a subordinate is the trust that the subordinate has in the supervisor (Butler, 1983). This reciprocity of trust seems to drive the relationship. Similarly, when members perform well they are trusting that they will be rewarded in some way (e.g., more delegation, stronger leader-member-exchange relationship, etc.), and the leaders trust that tasks will be completed in an efficient manner. This pattern typifies the behavioral aspect of trust (Lewis & Weigert, 1985). These interacts of relationship testing are critical to the LMX process.

It is here that managers and subordinates begin to cement the relationship and move toward interlocked patterns of behaviors.

> *Hypothesis 2: Within and across periods of time, member performance and leader delegation should be positively related.*

Role Routinization and Affective Trust

After the development phase, the behaviors of a leader and a member are much more predictable (Graen & Scandura, 1987). If a dyad is developing a high-quality leader-member-exchange relationship, a social component augments the task-focused relationship in which only performance and delegation are exchanged. This stage can be thought of as the affective trust outcome of high-quality leader-member exchange, the establishment of an emotional bond (Lewis & Weigert, 1985).

It is important to note that we are not saying that the relationship ends here. Obviously, relationships continue to evolve and change throughout their existence (Mayer et al., 1995). Those changes, however, are less an issue of LMX development and more an issue of relationship maintenance. We propose that the events that take place during the early stages combine to shape later leader-member-exchange relationship.

The quality of leader-member exchange is expected to be the result of the cumulative effects of similarity, delegation, and performance judgments, the result of the history of the relationship. We make this argument for four reasons. First, although previous models do not contain unequivocal statements about the role of time in LMX development, they suggest that it emerges from a pattern of behavior over time (Dienesch & Liden, 1986; Graen & Scandura, 1987). A cumulative effect hypothesis is consistent with that view. Second, previous research indicates that each of the elements of the model in Figure 1 has been related to leader-member exchange or other dyadic relationships in other research settings (e.g., similarity, Turban & Jones, 1988; affect, Buunk, Doosje, Jans, & Hopstaken, 1993; delegation, Scandura et al., 1986; Schriesheim et al., 1991; performance, Dansereau et al., 1975; Liden & Graen, 1980; Liden et al., 1993; Scandura & Graen, 1984; Scandura et al., 1986; Wayne & Ferris, 1990). Therefore, unique effects for each of these variables appear possible and are examined here. Third, as communication research and Graen and Scandura (1987) have suggested, the pattern of interacts over time defines leader-member-exchange relationships. Thus, one would expect leader-member exchange to be related to the cumulative effects of both delegation and performance judgments. It is not the most recent interact that defines the quality of exchange, but the cumulative effect. Finally, leader-member exchange is a developmental process, a process of leader and member learning about each other over time. The LMX process has much in common with socialization processes that have been studied on a larger scale. In that field, arguments and findings are suggesting that such learning processes tend to be cumulative (e.g., Bauer & Green, 1994). We expected a similar pattern here. Therefore,

> *Hypothesis 3: The quality of a leader-member exchange should be related to the cumulative effects of gender and affectivity similarity, leader delegation, and member performance.*

METHODS

Sample

Graduating students were contacted approximately two months prior to their graduation and asked to participate in this longitudinal study if they had accepted new jobs that would begin within two months of graduation. Respondents represented 52 majors (e.g., engineering, business, and social sciences), and each took a job with a different organization. A total of 311 graduating students returned time 1 surveys approximately three months before their organizational entries. More information about the exact job titles and college majors is available upon request from the first author.

At approximately 12 (time 2) and 34 (time 3) weeks after job entry, we collected data from both the graduates and their supervisors. At time 2, we received 223 member surveys (a 72 percent response rate) and 173 leader surveys (56 percent overall response rate, 78 percent of the leaders contacted). At time 3, 205 member surveys were returned (66 percent overall response rate, and 92 percent of the members contacted). At this time, 118 leader surveys were returned (38 percent overall response rate, 68 percent of the managers contacted). Only dyads that did not change between data collections were eligible for participation in this study. Complete, eligible dyadic data at time 2 were present for 165 dyads (53%) and at time 3 for 112 dyads (36%). Individuals in the final sample used for hypothesis testing had an average age of 23.47 years (s.d. = 2.90), and there were approximately equal numbers of women and men. In the original sample of 311, the mean age 23.52 (s.d. = 2.90), and 144 of the respondents were women, 167 men.

Procedures and Measures

The 311 graduates completed an initial survey at time 1 that assessed variables including demographic characteristics, starting salaries, job descriptions, prior work experience, and positive affectivity; they were also asked when and where they would start work. Time 1 surveys were returned through campus mail; each respondent also included a copy of his or her résumé. About two months after the graduates began work (time 2), we sent them a second survey that assessed variables such as quality of leader-member exchange, leader delegation, and how long they had been on their jobs. In addition, we asked the graduates to provide their supervisors' addresses so a short survey could be sent directly to those individuals. Respondents who did not furnish addresses were sent supervisory surveys and asked to give them directly to their supervisors. Supervisors were asked to provide member performance ratings.

Finally, at time 3 (approximately 34 weeks after beginning their new jobs), the graduates rated their supervisors' delegation behavior and the quality of leader-member-exchange relationships with their supervisors. Supervisors were asked to complete a positive affectivity scale, to give personal demographic characteristics, and to again rate member performance. All surveys were returned directly to the first author in postage-paid, self-addressed envelopes.

At time 2, we collected 165 usable supervisor surveys (119 directly and 46 via the graduates). A total of 112 usable supervisor surveys were collected at time 3 (85 directly and 27 via the graduates). To check for data comparability, we conducted *t*-tests contrasting the researcher-solicited and member-solicited leader surveys and found no significant differences for leader-member exchange, performance, delegation, gender, or affect similarity.

Additional *t*-tests were performed to test for differences between those who returned all three surveys and those who did not. The results of the *t*-tests revealed that for positive affectivity, age, gender, and number of job offers received, no differences existed. There were only significant differences in salary and full-time work experience: those who returned all surveys had one month less work experience and made $273 less per year than those who did not return all three surveys.

Deciding which time frames were most appropriate for data collection was challenging. Graen and Scandura (1987) considered around three months from job initiation to demarcate the first phase of leader-member-exchange development, role taking. Liden and colleagues (1993) found evidence to support the idea that relationships form very quickly. Unfortunately, no empirical evidence has been offered regarding the demarcation of one phase from another. We chose between two and three months for the first postentry data collection and approximately nine months for the last data collection. Although we do not yet know the exact relevant time frames for LMX development, these time periods have been used in studies of new employee adjustment (Morrison, 1993).

All correlations, means, standard deviations, and coefficient alphas for measures appear in Table 1. We used established measures with known psychometric properties and factor-analyzed all measures individually by source and time period using principal factors components analysis with varimax rotation. Each measure represented one factor when analyzed individually. In addition, we factor-analyzed leader-member exchange and delegation together by time period. At time 2, leader-member exchange and delegation did not produce clean solutions. Although two factors did emerge, items cross-loaded and were not loading cleanly on any particular factor, even after rotation. When leader-member exchange and delegation were analyzed separately, the solutions were clean, single factors. When analyzed together at time 3, a clean, two-factor solution emerged, with delegation items loading on one factor and leader-member-exchange items load-

TABLE 1
Descriptive Statistics and Correlations[a]

Variable	Mean	s.d.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Gender similarity	0.35	0.40																	
2. Positive affectivity similarity	0.76	0.56	.11																
3. Performance, time 2	5.50	1.32	.06	.40	(.96)														
4. Delegation, time 2	3.65	1.09	.08	.05	.31	(.80)													
5. Leader-member exchange, time 2	4.82	1.23	.07	.28	.48	.36	(.93)												
6. Performance, time 3	5.60	1.26	.05	.27	.61	.23	.46	(.95)											
7. Delegation, time 3	3.70	1.08	.08	.11	.36	.38	.21	.40	(.77)										
8. Leader-member exchange, time 3	4.81	1.23	.00	.23	.35	.18	.54	.57	.38	(.94)									
9. Salary, time 1[b]	35.6	9.5	.03	.00	.09	.03	.07	.05	.12	.08									
10. DOT data rating, time 1[b]	1.17	0.90	.05	.07	−.05	.04	−.08	.05	.03	−.09	.04								
11. DOT people rating, time 1[c]	5.65	1.22	.12	.11	.00	.10	−.09	.14	.04	.04	−.13	−.02							
12. DOT things rating, time 1[b]	4.39	2.74	.09	.11	.08	.04	.06	−.11	−.01	−.09	−.15	.27	−.30						
13. Contact hours, time 2[c]	12.34	13.87	.04	.03	.08	.05	.18	−.09	.00	−.03	−.19	.01	.09	.13					
14. Tenure, time 2[b]	11.83	4.29	.09	.04	.09	−.04	−.03	.09	.09	.01	−.11	−.02	.12	.04	.11				
15. Tenure, time 3[c]	34.42	5.71	.15	.12	−.05	−.12	−.05	−.24	−.12	−.05	−.15	−.14	.02	.00	.16	.23			
16. Age, time 1[b]	23.47	2.90	.01	.12	.11	.02	.13	.06	.07	.10	.31	.10	−.22	.12	−.09	−.05	−.04		
17. Grade point average, time 1[b]	3.45	0.22	.07	.11	.11	.09	−.02	.07	.05	−.07	.18	−.08	−.01	−.06	−.02	.07	.02	.07	
18. Work experience, time 1[b]	10.65	15.23	.05	.04	.06	.04	.05	.04	.04	−.03	.16	−.08	−.06	.09	.02	.01	−.07	.22	.06

[a] Correlations greater than .14 are significant at $p < .05$. Correlations greater than .24 are significant at $p < .01$. The range of n is from 112 to 311. Alphas are in parentheses along the diagonal. Salary is in thousands of dollars.

[b] Control variable.

[c] Control variable used in regression equations.

ing on the other factor. We determined factors using a combination of decision rules: eigenvalues greater than one, scree plot, high factor loadings, and theoretical rationale (Ford, MacCallum, & Tait, 1986). On the basis of theoretical rationale and the complete picture of factor solutions across time, we decided to retain leader-member exchange and delegation as separate factors.

Gender similarity. Gender was dummy-coded for each member and for each leader with 1 representing men and 0 representing women. Following Liden and colleagues (1993), Turban and Jones (1988), and Kurdek (1993), we derived relational scores by using the absolute difference between leaders' and members' scores. The mean gender similarity score was .35 (s.d. = .40).

Affectivity similarity. Positive affectivity was measured using the ten items from the Positive Affect Negative Affect (PANAS) scale (Watson et al., 1988). The PANAS scale consists of two subscales, negative and positive affect, but only positive affect was used here. The PANAS is internally consistent and has been shown to be stable over a two-month time period (Watson et al., 1988). Both members and leaders were asked to note how often they felt the PANAS items described how they had felt, on average, over the past year. We chose the longer time frame to capture the more stable, personality-based type of affectivity rather than mood or state affectivity (Watson et al., 1988). Response categories ranged from 1, very slightly or not at all, to 5, very much. An absolute difference score was created. The mean difference for positive affectivity was .76 (s.d. = .56). Because the reliability of a difference score is a function of the reliability of its components, it is important that the component reliabilities be relatively high (Johns, 1981). Coefficient alphas for positive affectivity were .95 for supervisors and .87 for members. These reliabilities lessen the possibility of the potential problems associated with difference scores (e.g., Edwards, 1994; Johns, 1981). This is discussed in further detail in the Results section.

Member performance. Member performance was rated by the leaders at times 2 and 3 using the five positively worded items from a scale developed by Katz (1964). Supervisory ratings of performance are desirable because it is the leader's perception of performance that is theorized to drive the role-making process (Graen & Scandura, 1987) and because subordinate performance is often proposed as a dominant variable in subordinate-leader relationship development (e.g., Graen & Scandura, 1987). A sample item is "This employee performs essential duties effectively." Responses ranged from 1, strongly disagree, to 7, strongly agree. This scale has shown good reliability and a single factor loading in the past (Basu, 1991). The mean for early (time 2) performance for this sample was 5.50 (s.d. = 1.32), and for later (time 3) performance, the mean was 5.60 (s.d. = 1.26). The coefficient alpha for subordinate performance was .96 at time 2 and .95 at time 3.

Leader delegation. This variable was based on members' assessments. The delegation items were taken from the long form of Yukl's (1990) Management Practices Survey (MPS). We chose this instrument for several reasons. The behaviors it assesses are generic ones applicable to many types of managers and organizations. Moreover, nearly 20 years have been spent on developing and validating the MPS, and several studies have shown that it has sound psychometric properties, displaying evidence of content validity, alphas above .80, high interrater reliabilities, stability across time, and criterion-related validity when non-method-bound measures of performance are used for assessment (Yukl, Wall, & Lepsinger, 1990). Subordinates rated their supervisors by reporting how often they engaged in two delegation behaviors. "My manager asks me to assume the responsibility for carrying out some activity or task, and let's me handle it his/her own way without interfering" is a representative item from the MPS. Responses ranged from 1, never, not at all, to 5, always. The mean for early (time 2) delegation was 3.65 (s.d. = 1.09). The mean for later (time 3) delegation was 3.70 (s.d. = 1.08). The coefficient alpha for delegation at time 2 was .80, and at time 3 it was .77.

Quality of leader-member exchange. This variable was also based on members' assessments. We revised the seven-item scale by Scandura and Graen (1984) following the seven-point "strongly agree" and "strongly disagree" options and word changes made by Liden and colleagues (1993). In addition, we split one item ("Do you usually feel that you know where you stand . . . do you usually know how satisfied your immediate supervisor is with what you do?") into two separate items ("I usually know where I stand with my manager" and "I usually know how satisfied my manager is with me"). The resulting eight-item measure is extremely similar to the seven-item scale, which has shown adequate variance, a single factor structure, a high coefficient alpha (.92), and low correlations with scales of social desirability and acquiescence (Liden & Maslyn, in press). Examples of items are "My manager recognizes my potential well" and "I would characterize the working relationship I have with my manager as extremely effective." The mean for this scale at time 3 was 4.81 (s.d. = 1.23). The coefficient alpha for this scale was .94.

Control variables. Several control variables were used. To control for the amount of time that subordinates had been on the job, we measured tenure in weeks. For time 2, the mean was 11.83 (s.d. = 4.29); for time 3, the mean was 34.42 (s.d. = 5.71). This control was important because each graduate started his or her job at a different time. To control for varying amounts of responsibility on the job as well as job design differences, we used initial salary levels as a surrogate for responsibility (mean = $35,613, (s.d. = $9,517) as well as the Dictionary of Occupational Titles codes for the extent to which a job involves dealing with people, data, and things (e.g., machinery). The DOT codes are widely used as a standard for occupational description and classification (Rousseau, 1982) and have been shown to have good reliability (Geyer, Hice, Hawk, Boese, & Brannan, 1989). The codes for data (range = 0 to 6), people (range = 0 to 8), and things (range = 0 to 7) describe the complexity of skills associated with job-related activities; lower values represent greater specialization. We based DOT ratings on the job title and job description given by each member. A rater then reevaluated a random sample of 50 job titles (of the potential 311 job titles) on these three dimensions; the result was 94 percent agreement for data and people ratings, and 96 percent agreement for things. For the sample, the mean for data was 1.17 (s.d. = .90); for people, it was 5.65 (s.d. = 1.22); and for things it was 4.39 (s.d. = 2.74).

Further control variables were work experience, age, and ability, all previously hypothesized to matter in the leader-member-exchange developmental process (Dienesch & Liden, 1986), although more recent studies discount these predictions (e.g., Liden et al., 1993). To be conservative, we measured full-time work experience (mean = 10.65 months, s.d. = 15.23), age (mean = 23.47, s.d. = 2.90), and college grade point average (mean = 3.45, s.d. = .22) on a four-point scale coded from the résumés. Finally, dyadic contact hours have been shown to be related to performance evaluation decisions (Judge & Ferris, 1993) and affective trust (McAllister, 1995). The graduates provided data for this control variable; the mean was 12.34 hours per week (s.d. = 13.87).

RESULTS

All hypotheses were tested using multiple regression analysis. Tables 2–4 contain the regression results, including standardized coefficients and the overall F, R^2, and adjusted R^2 for each equation. We examined potential control variables at the bivariate correlation level. Tenure at time 2, salary, ratings on the DOT dimensions data and things, grade point average, age, and work experience were not systematically related to any of the independent or dependent variables, so they were dropped from further consideration. Initial analyses revealed that tenure at time 3 was significantly related to member performance at time 3; we therefore included it in all time 3 analyses as a control. Dyadic contact hours were significantly related to the quality of leader-member exchange at time 2 and were therefore included in all subsequent analyses as a control variable. And finally, the DOT variable for people was significantly related to time 3 performance and was therefore included in all subsequent analyses as a control variable.

Hypothesis 1 predicts that members in same-gender dyads and members with personalities similar to their leaders' in terms of positive affectivity will have higher supervisor performance ratings than those in mixed-gender dyads and those with dissimilar personalities. Hypothesis 1 further predicts that these similarity indexes will be related to higher levels of delegation. To test this hypothesis, we conducted four separate regression analyses (generated by the two outcome variables measured at two points in time). The first equation predicts time 2 performance. As Table 2 shows gender similarity was unrelated to time 2 performance, but affectivity similarity was significantly related to it ($\beta = .40$, $p < .01$). For time 3, gender similarity was again unrelated to performance and positive affectivity similarity was significantly related ($\beta = .25$, $p < .01$). Gender and affectivity similarity were unrelated to

TABLE 2
Results of Multiple Regression Analysis for Member Performance[a]

Variables	Performance, Time 2	Performance, Time 3
Delegation, time 2	.30**	−.01
Delegation, time 3		.11
Performance, time 2		.52**
Gender similarity	.07	.02
Positive affectivity similarity	.40**	.25**
Dyadic contact hours, time 2[b]	.02	−.07
DOT people rating, time 1[b]	−.08	.12
Tenure, time 3[b]		−.11
F	7.58**	12.18**
n	112	112
R^2	.26	.48
Adjusted R^2	.23	.45

[a] Standardized regression weights are reported; their significance is based on F-tests.

[b] Control variable.

* $p < .05$

** $p < .01$

delegation at times 2 and 3 both (Table 3). Therefore, there was only partial support for the hypothesis.

In addition, because this is one of the first studies to examine affectivity in leader-member-exchange context, we tested the change in R^2 resulting from the addition of positive affectivity. Prediction of performance at time 2 saw an increase of .08 with the addition of the affectivity variable; prediction of performance at time 3 saw an increase of .04; and no changes occurred for delegation at times 2 or 3.

Hypothesis 2 states that member performance and leader delegation will be related to each other both within and across time periods. Correlations between time 2 performance and delegation are significant at time 2 ($r = .31$, $p < .01$) and at time 3 ($r = .40$, $p < .01$). Hypothesis 2 is supported within time frames. To evaluate across-time relationships, we used the regression results for time 3 delegation and performance predictions (see Tables 2 and 3). Time 2 performance predicted time 3 delegation ($\beta = .27$, $p < .01$), but time 2 delegation did not predict time 3 performance. Therefore, Hypothesis 2 is partially supported.

Hypothesis 3 states that leader-member-exchange quality should be related to the cumulative effects of performance, delegation, and gender and affectivity similarity. We tested the cumulative effects of the development process by entering all of the variables measured over time into two regression equations. Thus, early levels of the variables were examined for their potential direct influences on the later quality of leader-member exchange. LMX was predicted by the variables within the model (time 1, 2, and 3 variables). Both time 3 performance ($\beta = .40$, $p < .01$) and delegation ($\beta = .34$, $p < .01$) were significantly related to the quality of leader-member exchange at time 3 (see Table 4). Neither the gender and positive affectivity similarity

TABLE 3
Results of Multiple Regression Analysis for Leader Delegation[a]

Variables	Delegation, Time 2	Delegation, Time 3
Delegation, time 2		.37**
Performance, time 2	.35**	.27**
Performance, time 3		.11
Gender similarity	.06	.06
Positive affectivity similarity	.08	.09
Dyadic contact hours, time 2[b]	.01	−.10
DOT people rating, time 1[b]	.11	.02
Tenure, time 3[b]		−.15
F	2.97**	8.24**
n	112	112
R^2	.12	.40
Adjusted R^2	.08	.35

[a] Betas with significance based on *F* are shown.

[b] Control variable.

* $p < .05$

** $p < .01$

TABLE 4
Results of Multiple Regression Analysis for Time 3 Leader-Member Exchange[a]

Variables	Quality of Leader-Member Exchange, Time 3	Change in Leader-Member-Exchange Quality[b]
Leader-member exchange, time 2		.48**
Performance, time 3	.40**	.25**
Delegation, time 3	.34**	.29**
Performance, time 2	.07	.02
Delegation, time 2	−.11	−.19*
Gender similarity	.01	.03
Personal affectivity similarity	.05	.02
DOT people rating, time 1[c]	−.04	.01
Dyadic contact hours, time 2[c]	.01	−.11
Tenure, time 3[c]	−.07	−.07
F	8.51**	13.73**
n	112	112
R^2	.43	.58
Adjusted R^2	.38	.54

[a] Betas with significance based on *F* are shown.

[b] From time 2 to time 3.

[c] Control variable.

* $p < .05$

** $p < .01$

nor time 2 performance and delegation were related to time 3 leader-member-exchange quality after the other predictors were taken into account. The next test was to see whether the cumulative effects predicted the change in leader-member exchange from time 2 to time 3 by controlling for the level of time 2 exchange quality when predicting it at time 3. Again, time 3 performance ($\beta = .25$, $p < .01$) and time 3 delegation ($\beta = .29$, $p < .01$) were significant predictors. In addition, time 2 delegation was a significant predictor of the change in leader-member exchange ($\beta = -.19$, $p < .05$). Also as expected, time 2 exchange quality was a significant predictor of time 3 exchange quality ($\beta = .48$, $p < .01$). Therefore, Hypothesis 3 is partially supported. Affectivity was related to the change in R^2 resulting from the prediction of leader-member exchange (but not the change in LMX) of only .01.

The reliabilities of the difference scores created to assess similarity were relatively high, so it seemed simpler and more understandable to keep the analysis as it was rather than to apply more complicated alternatives (e.g., Edwards, 1994). We employed Johns's (1981) procedure to see if entering the components of the difference score radically changed the findings. In summary, the different analyses did not reveal significantly different results. In most cases, the R^2 and adjusted R^2 for regression equations went up, but significant predictors did not differ. For example, when predicting time 2 performance, delegation was still significant, along with subordinate and supervisor positive affectivity and the interaction term for these two variables. When predicting time 3 performance, time 2 performance was still significant, as was the positive affectivity interaction term. Predictions of delegation at times 2 and 3 were the same as were those for leader-member-exchange quality. So, because the reliabilities of the component scores were so high and because adding four additional variables made the analyses more complicated, but not more effective at predicting the dependent variables of interest, we retained our original data analysis strategy.

DISCUSSION

Summary of Findings

In this study, we found general support for the leader-member-exchange developmental model proposed and made a number of theoretical contributions. The findings generally confirm a dynamic process theory that is consistent with viewing LMX development as a trust-building process. Personal characteristics and behaviors that would be expected to be related to trust between leaders and members were related to each other and the quality of leader-member exchange experienced. Although such arguments have existed for some time, they have not been drawn together into a model or widely tested. Moreover, this work also demonstrates that performance-delegation interacts can be an integral part of LMX development. Delegation proved to be a very useful predictor of exchange quality in this work. These findings, coupled with past findings (e.g., Scandura et al., 1986), suggest that delegation should be considered as a pivotal variable in understanding leader-member interacts and leader-member-exchange development. In addition, a new relational personality variable was introduced and proved to be a potentially useful addition to understanding of LMX development. The longitudinal analyses, however, revealed what appears to be some particular dynamics in the way these exchanges unfold over time. An examination of specific findings is needed to see clearly some of the nuances of this apparent trust-building process.

Personality similarity between leader and member, measured in terms of positive affectivity, was related to later developmental processes, which in turn were related to the quality of leader-member exchange and changes in it over time. Gender similarity showed disappointing predictive power, failing to predict any of the variables of interest. This finding stands in stark contrast to other studies of demographic similarity (e.g., Tsui & O'Reilly, 1989). It is, however, consistent with other previous research findings. Orbell, Dawes, and Schwartz-Shea (1994) found that neither men nor women used gender as a criterion to predict who could be trusted to cooperate, and McAllister (1995) found that dyadic similarity on gender was not related to trust development. The lack of support for gender similarity may also be a result of sample composition. All of the dyads in the current study were newly formed. It may be that, contrary to past theorizing, gender similarity plays a greater role late in relationships than it does early in them. Future research is needed, however, before firm conclusions regarding gender similarity and leader-member-exchange development can be made.

In contrast, similarity in a leader's and a member's positive affectivity was consistently related to early and later performance judgments levied by the leader. This finding held over two time periods, indicating that affectivity similarity was related to early judgments about the member's performance as well as subsequent changes in those performance judgments by the leader. The more similar the leader and member were on this variable, the higher the leader's performance rating of the member at time 2 and the greater the increase in that performance rating between time 2 and time 3. Given the myriad of factors that might affect performance ratings, this appears to be a fairly robust finding.

It should also be noted that affectivity similarity showed zero-order relationships to leader-member-exchange quality ($r = .23$, $p < .05$). That relationship disappeared, however, when we controlled for the performance and delegation variables. Thus, personality similarity in this study appears to be related to leader-member-exchange development, but indirectly so. Personality affects early interaction patterns, which in turn are related to quality of exchange. This work, therefore, supports the theoretical proposition that leader and member characteristics (at least relational personality), can be significant initial influences on the development of leader-member exchange but appear to be mediated by behavioral processes. It may be that this type of similarity matters early on, as Dienesch and Liden (1986) proposed, but that other factors, such as member performance, matter more later in relationships.

Interacts of member performance and leader delegation also appeared to be related as predicted, but again, the pattern departed from the hypotheses. Within both time periods, performance and delegation showed significant zero-order relationships, but the magnitude of those relationships diminished over time. Furthermore, when we considered other variables in a multivariate model over time, the pattern of the performance-delegation relationships became more complex and suggested a particular sequence of interacts between leader judgments about member performance and the amount of delegation leaders used. Early in the leader-member-exchange development process—at three months (time 2)—performance and delegation are significantly related. At nine months (time 3), with earlier levels of performance and delegation controlled, there is no significant relationship between the time 3 performance ratings and leader delegation. In addition, at time 3, time 2 performance ratings positively predict time 3 delegation levels, but time 2 delegation does not predict time 3 performance.

This pattern between performance and delegation across time appears consistent with the trust-building and testing model of LMX development that Graen and Scandura (1987) depicted. It also may suggest something about how early LMX developmental processes affect later development. It appears that leaders may use increased levels of delegation as a reward for performance already delivered by a member. From this perspective, the leader is not delegating to enhance member performance, although he or she may certainly hope for that outcome. Rather, the leader provides increased responsibility and latitude for a member after that member is seen as performing well. This pattern is also consistent with the trust-building logic used here. Delegation is more likely to occur after a leader is assured, or trusts, that the subordinate can perform at a high level. It is also noteworthy that early ventures into this exchange process affect later interacts. Once we controlled for time 2 levels of performance and delegation, time 3 performance and delegation were no longer related. This finding suggests that for this time frame, the meaningful variance in the relationship between performance and delegation has already been explained by interactions at time 2.

Finally, the predicted relationships between the performance-delegation interacts and leader-member exchange were strongly supported. Member performance and delegation predicted both the quality of exchange at time 3 and increases in the quality of exchange between time 2 and time 3. Thus, it appears that a leader's judgment about a member's performance is an important predictor of leader-member exchange. In addition, the increased responsibility and latitude the leader grants to the member through delegation is strongly associated with a better quality of exchange, regardless of member performance levels. This finding is consistent with the two major theoretical models of LMX development (Dienesch & Liden, 1986; Graen & Scandura, 1987) and empirically establishes for the first time the important role delegation can play in the development of leader-member exchange. Leaders who want good relationships with their subordinates might consider going out of their way to delegate to new employees both early and late in their relationships. The negative relationship between time 2 delegation and changes in leader-member exchange from time 2 to time 3 is also consistent with the temporal nature of the leader-member-exchange development process. In essence, this coefficient means that the more delegation that is reported at time 2, the smaller the change in exchange quality over time. This pattern may indicate that LMX relationships appear to develop quickly and that the earlier use of delegation has already strengthened the quality of exchange. Thus, more delegation at time 2 is associated with less LMX development after that time. Nevertheless, as can be seen in the same equation, greater amounts of delegation at time 3 were still positively related to increases in exchange quality between times 2 and 3. Thus, early exchange processes don't seem to limit the development of exchanges, but they do provide a basis for later exchange processes.

A pattern emerges from the findings as a whole that may offer a glimpse into the dynamics of LMX development. Personality similarity is positively related to leaders' performance evaluations of members. These performance evaluations in turn are associated with leaders' decisions to delegate more to good performers. Over time, then, both member performance and amount of delegation are strongly associated with the quality of exchange and increases in that quality. In fact, these interacts of performance and delegation now displace personality similarity as a predictor of leader-member exchange. Thus, it appears personality similarity may predispose a leader to see a member in a positive light, or it may be that personality similarity actually facilitates member performance. Thus, personality similarity gives the development process a nudge in the right direction. Later, the interacts between performance judgments and delegation become the dominant variable related to the quality of the exchange that develops between leader and member. In addition, the temporal findings suggest that early interacts can set the tone for the leader-member-exchange process and, the better the development process is early on—that is, the more delegation occurs—the less development there is later.

As one anonymous reviewer pointed out, these results suggest that leaders may encourage sameness or homogeneity but, by implication, not diversity and heterogeneity. This observation is disturbing since homogeneity is not consistent with the realities of the increasingly diverse workforce. The influence of personality similarity begs the question of whether this similarity "causes" better performance or simply leads to higher halo performance ratings from the supervisor, which can be a source of bias. As noted earlier, Turban and Jones (1988) suggested that interpersonal similarity may influence dyadic interactions and therefore contribute to mutual liking and trust. Results of their study "suggest that similarity affects evaluations not only through bias, but also partly because of differences in supervisor-subordinate interactions" (Turban & Jones, 1988: 228). Kingstrom and Mainstone (1985) found that supervisors' ratings of personal acquaintance with their subordinates were significantly related to the performance ratings they gave the subordinates as well as to the objective performance measure of actual sales performance. This finding suggests that both mechanisms are probably operating. Organizations and supervisors should take care to base performance decisions on objective criteria rather than solely on more potentially biased subjective criteria. This is easier said than done, however, since much of the similarity-attraction paradigm may operate on a subconscious level.

Study Strengths and Limitations

A correlation between two measures can be inflated if both are obtained from the same person at the same time using the same data collection technique. We took three steps to decrease this threat to validity: First, the collection of independent and dependent variables was separated in time when possible. Podsakoff and Organ wrote that separating measures in time "mitigate[s] the problem of transient mood state and common stimulus cues, and perhaps reduces the effect of respondents' strain toward consistency" (1986: 540). Second, we collected data from members as well as leaders, eliminating the concern of common method bias for some measures. And third, tests were conservative in that we controlled for additional variables that might covarying with predictors and criteria. Unfortunately, these three steps caused the sample size to go down to a low of 112 rather than the 205 possible for tests based on member data only. So although we could be somewhat confident that method variance was not inflating the observed relationships, statistical power was decreased.

Another weakness of this study is the use of the MPS delegation items. As mentioned previously, over 20 years have been spent validating and testing the scale from which this subscale comes. Unfortunately, our measure of delegation only contains two items. It would have been more desirable to use a greater number of items or an objective approach to measuring delegation such as that used by Leana (1986). Unfortunately, it was not possible to collect objective, observational data here. Each member was in a different job and therefore, a more general measure of leader delegation was needed. Given the potential weakness of the delegation measure we employed, future studies should try to replicate these findings using objective, measures of delegation and perhaps of other leader behaviors as well, or multifaceted measures, or both.

Another measurement issue concerns our use of an 8-item version of the original leader-member-exchange 7-item scale from Scandura and Graen (1984). Theorists (e.g., Dienesch & Liden, 1986; Gerstner & Day, 1995; Graen & Uhl-Bien, 1995) have pointed out that prior work has used many different measures of leader-member exchange; these include a 2-item measure (Dansereau et al., 1975), a 4-item measure (Liden & Graen, 1980), a 7-item scale (Scandura & Graen, 1984), and an up-to-12-item measure (Wakabayashi & Graen, 1984). These differences hinder direct comparisons of LMX studies.

In a comprehensive metaanalytic study of 88 independent LMX samples, Gerstner and Day (1995) found that exchange quality was measured using over 16 different instruments. Although several of the scales varied considerably more from the leader-member-exchange 7-item measure than our modified 8-item measure did, the type of scale used did not seem to influence the finding of a strong positive relationship between LMX quality and performance. Further, the results indicated that internal consistency estimates were generally acceptable regardless of the type of measurement instrument used. And finally, when we conducted the LMX analyses using a 7-item measure (by combining the two split items into one), results did not change. In summary, although debate still continues (e.g., Liden & Maslyn, in press) regarding which measure or measures are the most appropriate for systematic use in studies, we acknowledge that our use of the modified leader-member-exchange 7-item scale may decrease the comparability of our findings to studies using different scales. Therefore, we encourage other studies of the LMX development process to see if these findings can be replicated using the same and other measures of exchange.

And finally, although we believe we addressed core issues in leader-member-exchange development, we acknowledge that other factors, such as liking, expectations, and contexts, have also been argued to affect LMX development (cf. Dienesch & Liden, 1986; Green et al., 1996; Liden et al., 1993). Unfortunately, such considerations were beyond the scope of this study.

Future Directions

Researchers have argued that trust is a key component of the quality of leader-member exchange. Drawing on that argument, we found evidence that variables that should contribute to trust building were useful predictors of leader-member exchange over time. Future work, however, should look to distinguish the roles of trust and trust building in LMX development. For some time, leader-member exchange has been criticized as an underdeveloped construct (e.g., Liden, Sparrowe, & Wayne, in press). Research that explicitly measures degrees of trust between leader and member and quality of exchange should be conducted to clearly test the importance of trust as part of LMX quality. The role of personality in leader-member-exchange development also appears to be a fruitful direction to pursue. Positive affectivity was a contributor here, but other measures need to be explored. Studying the "Big Five" measures of personality[1] would be a good place to start. For example, conscientiousness has consistently predicted performance (e.g., Barrick & Mount, 1991) and would seem likely to be related to the trust building we posit here. Finally, much more attention needs to be directed at the role of delegation in developing leader-member relationships. Better measurement, longitudinal designs, and more complete theorizing are needed to more fully understand the role delegation plays in leader-member exchange.

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[1] The Big Five are extraversion, emotional stability, agreeableness, conscientiousness, and openness to experience.

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SOCIAL CAPITAL AT THE TOP: EFFECTS OF SOCIAL SIMILARITY AND STATUS ON CEO COMPENSATION

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This study explored the effects of social capital, measured both absolutely and relatively, on CEO compensation in a sample of 61 CEO–compensation committee chairperson dyads. We controlled for variables representing economic, social comparison, and other social influence explanations for CEO compensation. Social similarity did not influence pay, but a chair's absolute social capital and a CEO's social capital relative to his or her chair's significantly increased CEO compensation. The potential of social capital explanations to increase understanding of the executive wage-setting process beyond that derived from simple economic theories is discussed.

In the past few years, authors have paid significant attention to CEO compensation. Although much of this writing has been popular (e.g., Crystal, 1991), an impressive amount of scholarly research has also accumulated (e.g., Pavlik & Belkaoui, 1991). Most of this research has been predicated on economic theories, including neoclassical notions of marginal product (e.g., Baker, Jensen, & Murphy, 1988; Deckop, 1988; Murphy, 1985), human capital theory (Hogan & McPheters, 1980), transaction cost economics (Williamson, 1988), agency theory (Gibbons & Murphy, 1992; Tosi & Gomez-Mejia, 1989), and tournament theory (Lazear, 1989; Main, O'Reilly, & Wade, 1993).

The study reported here tests a social influence perspective on CEO compensation by examining the effects of the social capital of two important members of boards of directors—a firm's chief executive officer (CEO) and the chairperson of its compensation committee—on CEO pay. Social capital refers to the resources available through social network and elite institutional ties (such as club memberships) that an individual can use to enhance

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his or her position (e.g., Bourdieu & Boltanski, 1978; Coleman, 1988; Flap & De Graaf, 1986; Sprengers, Tazelaar, & Flap, 1988; Useem & Karabel, 1986; Zweigenhaft, 1992). Useem and Karabel described social capital as "class-linked personal contacts or network ties that can be crucial to organizational and professional advancement" (1986: 185). Here, we conceptualize social capital in terms of both social similarity between a CEO and his or her compensation chair and the absolute and relative status of the CEO and the compensation chair. We hypothesize that social similarity and high status increase CEOs' influence over their compensation chairs, resulting in high CEO pay. We also hypothesize that low-status compensation chairs, particularly those who are of lower status than the CEO they are evaluating, will be more susceptible to influence and approve higher CEO compensation, even after controlling for firm performance and CEO characteristics. This study draws upon research indicating that social resources influence occupational attainment (e.g., Burt, 1992; De Graaf & Flap, 1988; Flap & De Graaf, 1986; Granovetter, 1973, 1974; Lin, Ensel, & Vaughn, 1981; Marsden & Hurlbert, 1988; Useem & Karabel, 1986), that status differences affect managerial behavior (e.g., D'Aveni & Kesner, 1993), and that social connections between a CEO and members of his or her board explain important board decisions (e.g., Wade, O'Reilly, & Chandratat, 1990).

Other studies have shown that traditional economic variables, particularly performance, are only weakly related to CEO compensation decisions. As Baker and colleagues noted, "The empirical relation between the pay of top level executives and firm performance, while positive and statistically significant, is tiny. On average, each $1,000 change in shareholder wealth corresponds to an increase in this year's and next year's salary of only two cents" (1988: 611). Many cross-sectional economic studies have explained only 20 to 30 percent of the variance in CEO compensation, and in some studies, economic variables have explained less than 10 percent of CEO pay (Crystal, 1991). Baker and colleagues noted that although there is an "enormous amount of research in the economics of contracting . . . [it] offers little guidance in understanding actual compensation arrangements in large organizations" (1988: 593). These authors concluded by suggesting this: "Ultimately, it may be that psychologists, behaviorists, human resource consultants and personnel executives understand something about human behavior that is not yet captured in our economic models" (1988: 615).

More psychological and political perspectives on executive compensation have also emerged (e.g., Finkelstein & Hambrick, 1989). For instance, O'Reilly, Main, and Crystal (1988) showed that CEO compensation significantly increased, beyond what could be explained by economic determinants, when the average full-time employment salary of a firm's compensation committee members was greater than that of its CEO. The authors argued that these findings were consistent with the operation of social comparison processes, whereby compensation committee members would anchor their judgments on their own salaries. More recently, Main, O'Reilly, and Wade (1995) investigated the possibility that social influence may operate via a CEO's managing a board and compensation committee in a manner that increases his or her compensation. For CEOs who are on nominating committees or were appointed to their boards before their compensation committee chairs, Main and colleagues reported significant increases in executive compensation beyond what either economic variables or social comparison processes could explain.

Other perspectives on CEO compensation have also generated results congruent with social psychological theories of influence. For example, agency theory suggests that boards of firms that have more concentrated ownership are better able to monitor CEOs and curb opportunism. Using this theoretical framework, Tosi and Gomez-Mejia (1989) found that in firms that had concentrated ownership, boards exerted more influence on CEO pay than in firms without such ownership. From a social psychological viewpoint, these results suggest that it is more difficult for CEOs to influence members of owner-controlled boards because board members may be less obligated to the CEOs. Wade and colleagues (1990) found that measures of a CEO's influence, such as the number of outsiders appointed to the board after the CEO, had much weaker effects on the adoption of golden parachutes in owner-controlled firms than in other firms. According to Wade and colleagues, "Social influence can be thought of as an organizational resource that can enable the agent (the CEO) to act opportunistically in his or her own interest at the expense of the principal (the shareholders)" (1990: 589). Other researchers (Lambert, Larcker, & Weigelt, 1993; Westphal & Zajac, 1994) have similarly examined the effects of CEO influence on compensation outcomes. For example, Westphal and Zajac found that CEO influence was positively associated with compensation and negatively associated with the adoption of long-term incentive plans emphasizing pay for performance.

Whereas studies based on economic theory are typically attempts to show that CEO compensation conforms to some theoretical perspective, such as agency or tournament theory, the more psychological approaches begin with the premise that the compensation-setting process relies on the deliberations of a small group of people a firm's compensation committee—and as such, may be affected by a number of psychological and political processes that shape individual and group decisions everywhere. A board's compensation committee has the specific task of setting CEO pay. By 1984, such committees existed in almost 90 percent of the *Fortune* 500 (Worthy & Neuschel, 1984). Of the members of a compensation committee, the chairperson is likely to work most closely with the firm's CEO, soliciting the CEO's salary recommendation and leading the compensation review. The chair is significant because, although any committee member can present information, the chair can use his or her formal authority to control the flow of information to the committee and frame the premises of the decision (Pfeffer, 1992). The general social norm of deference to authority (Cialdini, 1995; Milgram, 1974; Wilson, 1968) also contributes to the chair's potential influence. As Mueller noted, "Organizational influence is based in large measure on the seniority, positions, and titles given to individual members of the board" (1982: 45).

SOCIAL CAPITAL AND SOCIAL INFLUENCE

Influence may also be related to an individual's social network (Brass, 1984; Ibarra & Andrews, 1993). Although they all presumably garner prestige with jobs, top executives in American firms vary in the social capital they possess (Allen, 1978; D'Aveni, 1990; Domhoff, 1967; Mills, 1956; Useem, 1979; Useem & Karabel, 1986). Although much of the social capital literature focuses on the effects of networks on the occupational attainment of individuals at low and midlevels of organizations, evidence suggests that the same processes operate at the top (Useem & Karabel, 1986) and may become more important as individuals seek to advance in their careers (Burt, 1995). Because many decisions at the top of organizations are ambiguous and involve the use of social information (Kanter, 1977), social capital can provide social cues—such as the credibility and attractiveness of a source—that people may use in place of facts when a judgment task is ambiguous (Chaiken, 1987; Petty & Cacioppo, 1986). As Burt noted, social capital is most valuable "where an individual has to figure out for him or herself how to best perform the job" and then persuade others that the job performance is legitimate (1996: 11).

Two general perspectives on the role of social capital seem germane to the study of social resources and social influence over compensation. First, social capital can be viewed as based on social similarity, the shared affiliations or activities that indicate "how" one knows someone (Burt, 1992: 11). Social similarity has been found not only to increase liking (Lincoln & Miller, 1979; Tsui & O'Reilly, 1989), but also to increase influence (Cialdini, 1987). In a review of the social influence and conformity literature, Moscovici noted that "Many studies . . . have shown that ties of sympathy, a common past, group stability—everything that links us together—increase reciprocal influence" (1985: 367). Close relationships, defined as those involving mutual interdependence and interconnected activities (Kelley et al., 1983), can enhance social influence in a variety of ways, including increasing the similarity of experiences and inducing shared categorization (Tajfel, 1981), increasing homophily (liking for similar others) (Marsden, 1988), and enhancing a tendency toward less critical evaluation and greater reciprocity (Cialdini, 1987). There is ample evidence that resources are likely to be distributed preferentially when the members of a group share a common identity (Kramer, 1991), are friends (Aron, Aron, Tudor, & Nelson, 1991), perform interdependent tasks (Greenberg, 1979), and share demographic or other similarities (e.g., Tesser, 1988; Tsui, Egan, & O'Reilly, 1992). Byrne, Clore, and Worchel (1966), for instance, found that shared economic status was a basis for interpersonal attraction. In a laboratory experiment, Golightly, Huffman, and Byrne (1972) demonstrated that attitudinal similarity increased the amount of money subjects were willing to loan others.

Second, social capital can be viewed as an individual's personal network and elite institutional affiliations. As Burt suggested, "The first line [of research focused on social similarity] describes the network as a conduit, the second line describes how networks are themselves a form of social capital" (1992: 12). In this case, social capital refers to whom an individual knows rather than to how the focal person is connected to others (Burt, 1992: 11–12). From this perspective, networks can not only provide access to information regarding opportunities and consequently, to better career outcomes (e.g., Granovetter, 1974; Ibarra, 1992), but can also serve as a source of status (D'Aveni & Kesner, 1993).

Although social similarity and the absolute social capital indicated by a large personal network and elite affiliations should yield positive outcomes, we suggest that relative social capital—an individual's status compared to others' (e.g., Cohen & Zhou, 1991; Frank, 1985; Hambrick & Cannella, 1993)—may affect resource decisions. Theories of social evaluation (e.g., Gartrell, 1987; Suls & Wills, 1991; Zalesny & Ford, 1990) suggest how relative status can affect advancement and compensation. Different network resources create status differentials (Burkhardt & Brass, 1990; Ibarra & Andrews, 1993) that become potent sources of self-evaluation as well as bases for the evaluation of others (Kilduff & Krackhardt, 1994). Status affects social influence by structuring a person's social alternatives: low-status individuals are highly dependent on the few exchange relationships they possess (Burkhardt & Brass,1990; Cook, Emerson, Gillmore, & Yamagishi, 1983) and are therefore more susceptible to social influence attempts initiated by the other parties involved in those relationships, especially when the latter are of higher status. Higher-status contacts are valued in general (Cialdini, 1989; Kilduff & Krackhardt, 1994) but may be most desirable to those low in personal status. Kilduff and Krackhardt (1994) noted the following:

> The "pricing" of individuals in this [internal labor] market is a cognitive process that unfolds within a social context. An individual's performance is often difficult to assess, so people look for signals of quality (Spence, 1973). Does the person hold a high position in the organization? Is the person a friend of a prominent leader? In this cognitive assessment process, both individual attributes and social ties may contribute to the determination of performance reputation (1994: 89).

When conducted in the context of a psychologically significant group, these comparisons can form the basis for both individuals' self-evaluations (e.g., Kramer, 1991; Tsui et al., 1992) and assessments of others. In particular, evaluations of status shape expectations of others, and these expectations are significant predictors of behavior, such as interaction in a task group (Driskell & Mullen, 1990).

Individuals can choose to make these evaluations via either local comparisons to their immediate referent groups or more global comparisons to those in structurally equivalent positions (e.g., Burt, 1982; Ibarra & Andrews, 1993; Kilduff & Krackhardt, 1994). The latter, which are equivalent to Frank's (1985) "global" comparisons, are based upon attributes relevant to an equivalent set of people (for example, CEOs comparing themselves to other CEOs). Particularistic, or local, comparisons involve referents from an individual's immediate environment, regardless of role (Frank, 1985; Miller, Turnbull, & McFarland, 1988).

Research has typically not examined both types of comparisons simultaneously; the modal study examines either local or global comparisons, but not both. In the context of setting CEO compensation, it seems likely that a CEO and a compensation committee chair would make both types of comparisons, each comparing him- or herself both to others in equivalent external positions and to the other member of the CEO-compensation chair dyad.

In sum, exploring the impact of social capital, rather than human capital (an individual's knowledge, skills, and abilities, which can come from education, training, and experience [Becker, 1993]) takes into account the social context in which compensation decisions are made. Within this context, a compensation committee chair is likely to evaluate CEO performance heuristically, and the source credibility that CEO social capital produces becomes an important peripheral cue in the compensation chair's decision (Chaiken, 1987). Similarly, the compensation chair's status also functions in an important way, by determining his or her susceptibility to influence.

In examining CEO and compensation chair social capital absolutely (i.e., independent of any comparison within a dyad), we built upon the existing social capital literature. In considering the effects of status comparisons within the CEO–compensation chair dyad, we drew upon the framework D'Aveni and Kesner (1993) developed in exploring managerial reactions to takeover attempts and extended it to the compensation-setting domain. Our study extends existing work by testing the simultaneous effects on CEO pay of social similarity, absolute CEO and compensation chair status, and status comparisons made within the CEO–compensation chair dyad.

Adding structural and psychological variables to models of executive wage determination may improve understanding of how CEOs are compensated as well as provide a more realistic view of larger issues of board functioning and corporate governance (Lorsch, 1989; Walsh & Seward, 1990). Although the findings of O'Reilly and colleagues (1988) support the notion that CEO social influence may directly affect board decision making, they did not explicitly test this hypothesis. In the current study, we addressed both this hypothesis and the specific mechanisms through which social influence affects CEO pay. By disentangling the effects of similarity and status in a consequential real-world setting, we suggest refinements to theories of social capital and occupational attainment, social influence, and CEO pay.

SOCIAL CAPITAL AND CEO COMPENSATION

Since CEO wage setting is fundamentally an ambiguous task (March, 1984), and CEO-board relationships are often close (Lorsch, 1989; Main, O'Reilly, & Wade, 1995), social capital in the form of social similarity may affect CEO pay by enhancing the relationship between a CEO and a compensation committee chairperson (Berscheid, Snyder, & Omoto, 1989). In this case, the compensation chair is likely to allocate pay more generously. Therefore,

> *Hypothesis 1: High social similarity between a CEO and a compensation committee chairperson should be positively related to CEO compensation.*

Just as compensation committee chairs may use social relationships as information in setting CEO compensation, social comparisons regarding status—the extent and prestige of social resources—may also serve as an important input into the CEO pay decision. Crystal (1991) argued that CEOs do make such comparisons, paying very close attention to their status as reflected in their compensation compared to other CEOs'. This comparison may lead CEOs to make global comparisons; that is, to evaluate themselves relative to other CEOs. CEOs of higher status than other CEOs should be more able to use their status to influence those who set their compensation.

CEO absolute or global status (social capital relative to structurally equivalent others) alone may affect executive wage determination in two ways. First, as the social cognition literature suggests, in the absence of clear measures of a CEO's performance other than the CEO's human capital and firm performance, compensation committee members may view the CEO's global status as an important peripheral cue in setting compensation. Second, as resource dependence theory suggests, a CEO's social capital may be viewed as an important firm resource and a valid criterion in determining CEO pay. Therefore,

> *Hypothesis 2a: CEOs who are of higher social status than other CEOs are expected to receive higher levels of compensation than their lower-status counterparts.*

Similarly, compensation committee chairs may compare their own status to that of other compensation chairs. Members of corporate boards often value their positions, gaining both personal prestige and remuneration with each directorship (Lublin, 1991). Compensation committee chairs of higher status than others in comparable positions may feel less dependent upon any given board seat and less obligated to any particular CEO.

> *Hypothesis 2b: Compensation committee chairs of higher social status than other compensation committee chairs are expected to approve lower levels of CEO compensation than their lower-status counterparts.*

In addition to global comparisons that establish an individual's status relative to structurally equivalent others, CEOs and compensation committee chairs may conduct particularistic, or local, comparisons. These evaluations involve referents with whom the focal person shares a bond but who have different roles (e.g., a CEO comparing himself or herself to the chairperson of the compensation committee or to other board members who are not CEOs). Since research shows that differential social status predicts interaction in task groups both directly and indirectly, via its effects on expectations (Driskell & Mullen, 1990), and that it can alter the effectiveness of influence attempts (e.g., Moscovici, 1985), it may be that the status of CEOs relative to that of their compensation committee chairs will affect the compensation of the former. Whereas Hypotheses 2a and 2b consider a CEO and committee chair individually, with regard to their respective groups, Hypotheses 3a and 3b address the relative status of the CEO and compensation chair within the dyad they form.

> *Hypothesis 3a: CEOs who are of higher social status than the chairs of their compensation committees should receive relatively high levels of compensation.*

In contrast, the combination of standing relative to others in an individual's own group as defined by role (i.e., CEOs for a CEO and compensation chairs for a compensation chair) and local status comparisons across roles (between CEOs and chairs) may be the most potent determinant of social influence within a dyad.

> *Hypothesis 3b: CEOs who are of higher social status than other CEOs and whose compensation committee chairs are of lower social status than other compensation committee chairs should receive relatively high levels of compensation.*

Because social similarity may involve similarity in status as well as shared social experiences, we also considered the role of CEO and compensation chair similarity in status (with and without regard to their respective group status means);[1] however, we did not frame specific hypotheses.

METHODS

Sample

The original sample consisted of 105 large public corporations, representing nine industries, drawn from *Business Week*'s 1985 annual survey of executive compensation. We used data from COMPUSTAT and proxy statements to obtain information about each firm's performance and board of directors, including the CEO's compensation and the name and tenure of the CEO and chair of the compensation committee. O'Reilly and colleagues (1988) reported full details on this sample. For the present study, missing data reduced the sample size to 84 firms.

Additional data were also collected for this study. For each CEO–compensation committee chairperson dyad, we obtained social capital data from *Who's Who in Finance and Industry.* These data included career history, board memberships, club affiliations, trusteeships, educational attainment, and names of educational institutions attended. Whenever available, data for CEOs and compensation chairs were taken from the 1984–85 volume. For those individuals not included there, we searched other volumes of *Who's Who in Finance and Industry* and *Who's Who in America,* a directory of prominent Americans containing the same information and using the same research method as the finance and industry series. Of the 84 firms in the original sample, 16 did not name their compensation committee chairs in their proxy statements, reducing our sample to 68 firms. No information was available in *Who's Who in Finance and Industry* or *Who's Who in America* for seven compensation chairs. The final sample used here represents all those firms ($N = 61$) of the original 84 firms for which complete information on the CEO and compensation chair was available.[2]

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[1] We thank an anonymous reviewer for this suggestion.

To make sure that our sample was not biased, we checked figures for sales, CEO salary, and return on equity (ROE) in the reduced sample against those in the original O'Reilly et al. (1988) sample. The results of *t*-tests of the means of sales, CEO compensation, and ROE revealed no differences between the two data sets.

Control variables. To control for economic effects, we used both firm size and performance, measured respectively as the logarithm of sales and return on equity. Firms in the sample represented nine industries categorized in the *Business Week* survey. We created dummy variables for each of these industries and entered all but one (conglomerates) in the analyses.[3] Human capital variables (Hogan & McPheters, 1980) were CEO tenure, as indicated in the firm proxy statement, and educational attainment, obtained from *Who's Who.* When firm proxy statements omitted tenure information, we obtained it from *Who's Who* and *Business Week.* Tenure was coded in years. Educational attainment was coded as follows: no college degree, 0; college degree, 1; postgraduate degree, 2; second graduate degree, 3. When no undergraduate institution was indicated in *Who's Who,* we checked the proxy statement.

Social comparison effects were assessed using the logarithm of the average full-time employment salary of the outside executives on the compensation committee (O'Reilly et al., 1988). A dummy variable indicating whether a firm's CEO had been appointed to its board before the chair of the compensation committee became a board member was included to control for social influence resulting from the CEO's involvement in the compensation chair's appointment to the board (Main et al., 1995). Size of the compensation committee was also included as a control since previous research has suggested that influence diminishes when diffused over multiple targets of influence (Tanford & Penrod, 1984). We calculated committee size by counting the number of nominees in the 1984 proxy statement who were identified as serving on the compensation committee and who were up for election to the board of directors.[4]

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[2] For some firms in our sample, the only *Who's Who* entry available for the CEO or compensation chair was more than four years old. We repeated our analyses omitting these 5 firms from our sample and found no significant change in our results. Results presented here include these firms.

[3] Industries included were chemicals, drugs, electrical-electronics, miscellaneous manufacturing, natural resources, oil service and supply, paper and forest products, and publishing, radio, and television.

Social capital. Recall that social capital refers to both social similarity and status. For each dyad in the sample, we assessed social similarity in terms of overlap between the backgrounds of a firm's CEO and the chair of its compensation committee. We created dummy variables representing employment at the same firm (contemporaneous or noncontemporaneous) and attendance at the same educational institution, either as an undergraduate or graduate student. The number of shared *Fortune* 500 board memberships and shared memberships on other boards was also coded. We chose these measures to capture shared experiences and overlaps in social networks. To eliminate differences in scale between these individual measures, we first standardized each one and then combined the results to form the index of dyadic similarity used to test Hypothesis 1:

$$\mathit{Dyadic\ similarity} = \sum_{i=1}^{n} \sum_{j=1}^{m} \left(\frac{(\mathit{shared}_{ij} - \overline{\mathit{shared}_j})}{s_j} \right),$$

where n is 61, m is 4, shared_{ij} is dyad i's score on social similarity measure j, $\overline{\mathit{shared}_j}$ is the mean score of all dyads on social similarity measure j, and s_j is the standard deviation of all dyads on social similarity measure j.

Status represents the extent and prestige of an individual's social resources. To compute this variable we counted the total numbers of corporate board memberships, trusteeships (D'Aveni, 1990; D'Aveni & Kesner, 1993), and memberships in social clubs (Domhoff, 1967; Galaskiewicz et al., 1985; Mills, 1956), and the prestige of the undergraduate institution attended (D'Aveni, 1990; Galaskiewicz, Wasserman, Rauschenbach, Bielefeld, & Mullaney, 1985; Useem & Karabel, 1986). Following research showing the distinctive elite characteristics of the "Big Three" (Farnum, 1990a, 1990b; Karabel, 1984; Pierson, 1969; Synnott, 1979), we coded undergraduate affiliation with Harvard, Yale, or Princeton as 2, affiliation with any of the other 11 high-prestige institutions documented in Useem and Karabel (1986) as 1, and a nonelite educational background as 0. Because CEOs and chairs differed in mean numbers of board and club memberships (chairs had more), we again created standard scores for each variable and aggregated them to form a social status index.

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[4] This procedure could result in undercounting committee members if a former member of the compensation committee was not up for reelection to a board and was replaced after the annual meeting by another board member. However, because board turnover is not likely to be high in a single year, undercounting was likely to occur only rarely and unlikely to affect our results.

As we did in creating the dyadic similarity index, we first standardized each status measure to eliminate differences in scale. In standardizing each individual status measure to form a summary status index, different procedures were used to create indices appropriate to our hypotheses. To test Hypotheses 2a and 2b, we standardized CEOs' raw scores on each individual status measure using the mean and standard deviation for CEOs only and then summed results for the measures to form a global status index. Compensation committee chairs' raw scores were similarly standardized using the mean and standard deviation for those individuals only. More specifically, using the CEO example, the calculation was as follows:

$$\textit{CEO global status index} = \sum_{i=1}^{n} \sum_{j=1}^{m} \left(\frac{(score_{ij} - \overline{score_j})}{s_j} \right),$$

where n is 61, m is 4, $score_{ij}$ is CEO i's score on status measure j, $\overline{score_j}$ is the mean score of all CEOs on status measure j, and s_j is the standard deviation for all CEOs on status measure j. Since means for the compensation committee chairs on several of the individual status measures were higher than the CEO means, a CEO who received a high global status score might still be lower in raw status than a compensation chair with a low global status score. As noted, we used these indices to test Hypotheses 2a and 2b.

To test Hypothesis 3a, we created a dummy variable indicating each CEO's status relative to that of his[5] compensation committee chair using an index of CEO and compensation chair status and controlling for the mean status of the whole sample (i.e., CEOs and compensation chairs combined). We created this index by first standardizing CEO and compensation chair raw scores on each individual status measure using the mean and standard deviations from the entire sample and then summing these individual z-scores to produce a status index for each CEO and compensation chair. Specifically, using the CEO example, local status was created using the following formula:

$$\textit{CEO local status index} = \sum_{i=1}^{n} \sum_{j=1}^{m} \left(\frac{(score_{ij} - \overline{score_j})}{s_j} \right),$$

where n is 61, m is 4, $score_{ij}$ is CEO i's score on status measure j, $\overline{score_j}$ is the mean score of the full sample (all CEOs and compensation chairs) on status measure j, and s_j is the standard deviation for the full sample on status measure j. By using the full sample mean and standard deviation, we guaranteed that CEOs scoring higher than their compensation chairs in local status were, in fact, higher in raw status. If we had used the group means and standard deviations (as we did in constructing the global status indices), it would have been possible for a CEO of lower raw status to obtain a higher local status score than a compensation committee chair of higher raw status.

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[5] All the CEOs in the sample were men.

For each dyad in our sample, we then compared the CEO's local status to his compensation chair's local status. The local status dummy variable equals 1 when the CEO's local status index is greater than the chair's index and 0 if the CEO's local status index is lower than the compensation chair's.

Finally, to test Hypothesis 3b, we created four relational status variables capturing the relationships of a CEO and a compensation chair to their groups *and* to the other member of a dyad. To create these dummy variables, we first compared the global status index of each CEO and compensation chair to that for the individual's group. This dummy variable equals 1 if a CEO's status exceeds the mean for all CEOs in our sample, 0 if his status fell below the mean of CEO status in our sample. The same procedure was followed for compensation chairs. The final step in creating the relational status variables was comparing the CEO and compensation dummy variables within dyads. For example, the high-CEO/low-compensation chair relational status dummy equals 1 when the CEO is of high status relative to other CEOs and is paired with a compensation chair of low status relative to other compensation chairs. Whereas the local status variable was used to test the hypothesis that CEOs and compensation chairs compare their status most directly (i.e, within dyads), we used the relational status to test the hypothesis that CEOs and compensation chairs compare themselves to their groups as well as to each other. The relational status comparison of specific interest is the condition in which the CEO and chair are of opposite status (e.g., high-status CEO and low-status chair, as proposed in Hypothesis 3b).

CEO compensation. The dependent variable used here is the logarithm of the CEO's cash compensation (base and bonus) for the year 1984, obtained from the 1985 *Business Week* survey and checked against firm proxy statements.

Analyses

Means, standard deviations, and correlations were computed for each of the control, independent, and dependent variables. To test our hypotheses, we performed ordinary least squares regression analyses. A base model using only control variables derived from previous research on CEO compensation was estimated first. Additional models were used to test the effects of the social capital variables, including the different status measures. Industry controls were used in all analyses. The omitted industry group consists of conglomerates.

RESULTS

Table 1 presents means and standard deviations as well as the correlations among variables. Because all hypotheses are directional, one-tailed tests of significance are reported. The bivariate relationships are generally consistent with those found in earlier research. For instance, as expected from economic theory, CEOs in larger firms and in those with strong performance enjoy higher remuneration than other CEOs ($r = .38$, $p < .001$ and

TABLE 1
Means, Standard Deviations, and Correlations[a]

Variables	Mean	s.d.	1	2	3	4	5	6	7	8
1. CEO compensation	6.65	0.25								
2. Sales	6.00	0.80	0.38***							
3. ROE	14.84	7.02	0.41***	−0.14						
4. CEO tenure	7.64	6.05	0.03	−0.23*	−0.26*					
5. CEO education	1.67	0.68	−0.02	0.07	−0.18	0.02				
6. Compensation committee size	4.38	1.17	−0.04	0.20	−0.08	−0.07	−0.01			
7. Social comparison[b]	6.51	0.34	0.22*	0.26*	−0.10	0.09	0.14	−0.20		
8. Social influence[c]	0.57	0.50	0.15	−0.18	−0.07	0.61***	−0.08	0.02	−0.15	
9. Social similarity	0.00	2.13	0.02	0.01	−0.02	0.14	0.09	0.12	0.06	−0.02
10. CEO status, global	0.00	2.53	0.25*	−0.13	0.02	0.55***	−0.17	0.12	−0.08	0.41***
11. Chair status, global	0.00	2.28	0.11	0.21*	0.11	−0.16	0.04	0.04	0.11	0.09
12. CEO status > chair status, local	0.38	0.49	0.09	−0.38***	−0.05	0.46***	0.03	0.10	−0.18	0.26*
13. High CEO/low chair, local	0.23	0.42	0.13	−0.24*	0.13	0.38***	−0.14	0.19	−0.29**	0.23*
14. High CEO/high chair, local	0.20	0.40	0.15	0.10	0.02	0.04	−0.13	0.12	0.10	0.26*
15. Low CEO/low chair, local	0.34	0.48	−0.07	0.01	−0.10	−0.15	0.05	−0.21	0.14	−0.21*
16. High CEO/low chair, global	0.25	0.43	0.21*	−0.26*	0.15	0.39***	−0.17	0.11	−0.25*	0.26*
17. High CEO/high chair, global	0.20	0.40	0.15	0.10	0.02	0.04	−0.13	0.12	0.10	0.26*
18. Low CEO/low chair, global	0.33	0.47	−0.14	0.04	−0.13	−0.17	0.08	−0.14	0.11	−0.25*

[a] $N = 61$.

[b] Average full-time employment salary of compensation committee.

[c] Refers to CEO's presence on board prior to compensation chair's arrival.

* $p < .05$, one-tailed test

** $p < .01$, one-tailed test

*** $p < .001$, one-tailed test

$r = .41$, $p < .001$, respectively). The correlations offer no support for our similarity hypotheses. CEOs who are socially similar to the chairs of their compensation committees do not receive more pay than CEOs who do not share affiliations with their compensation chairs.

An additional way to construe similarity is as status similarity. Correlational results do not indicate that status similarity, regarding either high or low status, is associated with CEO compensation. The correlations offer modest support for status hypotheses. CEOs high in status (with the mean status of their group controlled for) earn significantly more compensation than CEOs of lower status ($r = .25$, $p < .05$). CEOs who are of high status relative to their group who are paired with compensation chairs of low status relative to other compensation chairs also earn significantly more compensation than other CEOs ($r = .21$, $p < .05$).

Table 2 presents the results of regression analyses. Model 1 includes only control variables on the left-hand side. As expected, sales and return on

TABLE 1 (continued)

9	10	11	12	13	14	15	16	17
0.25*								
0.02	0.03							
0.07	0.53***	-0.57***						
0.11	0.47***	-0.41***	0.70***					
0.20	0.46***	0.57***	-0.21*	-0.27*				
-0.27*	-0.46***	-0.49***	-0.07	-0.40***	-0.36**			
0.08	0.46***	-0.45***	0.73***	0.96***	-0.28*	-0.33**		
0.20	0.46***	0.57***	-0.21*	-0.27*	1.00***	-0.36**	-0.28*	
-0.25*	-0.47***	-0.46***	-0.11	-0.38***	-0.35**	0.96***	-0.40***	-0.35**

equity are positively and significantly related to pay. Consistent with earlier studies, the relationship between performance and CEO compensation is relatively small. A 5 percent rise in ROE (a significant achievement) results in only a 5 percent increase in pay for CEOs. The human capital measures (CEO tenure and CEO educational attainment) are unrelated to compensation in all models.

Model 2 reports the results of a test of Hypothesis 1. Social similarity, with economic and other psychological effects controlled, is not significantly related to CEO compensation.

Model 3 drops the social similarity index and enters the global status indices for the CEO and compensation committee chair. Counter to our prediction in Hypothesis 2a, CEO global status does not significantly affect CEO compensation, but consistent with Hypothesis 2b, increases in the global status of the compensation committee chair are associated with decreases in CEO remuneration. This effect remains significant even when social similarity is added in model 4. Although significant, the magnitude of the global status effects are relatively modest. On the face of it, only compensation chair's social status seems to be associated with variations in CEO compensation. A high-status compensation committee chair reduces CEO pay by approximately \$16,000 when evaluated at the sample mean for CEO salary (\$793,430).

The reason for the absence of CEO status effects becomes clear in models 5 through 10. Here it is obvious that absolute status matters less than status in relation to others. Models 5 and 6 show that, regardless of overall status, when CEOs are of higher status than compensation committee chairs, they receive significantly more money ($\beta = .16$, $p < .001$; Hypothesis 3a). In fact, CEOs who are of higher status than their compensation committee chairs receive pay more than 16 percent higher than that of those who are of lower status, a premium of approximately \$138,000 when evaluated at the sample mean.

Model 7 in Table 2 shows the effects of status pairings of the CEO and compensation committee chair on CEO compensation. The omitted comparison group consists of those dyads in which the CEO is of low status (relative to the full sample mean) and the compensation chair is of high status (relative to the full sample mean). Consistent with Hypothesis 3b, high-status CEOs paired with low-status chairs receive significantly more pay than low-status CEOs paired with high-status compensation chairs ($\beta = .17$, $p < .05$).

Models 8 and 9 replicate the analyses presented in models 5 and 6, this time substituting global for local status variables. The same pattern of results is obtained: CEOs of high status relative to other CEOs receive significantly more pay when their compensation chairs are of low status relative to other compensation chairs ($\beta = .13$, $p < .05$). This effect persists when social similarity is added in model 9.

Model 10 of Table 2 presents the effects of CEO and compensation chair relational status pairings when status is calculated at the global (i.e., group) level and compared within the dyad. The omitted category consists of those dyads in which the CEO is of low status relative to other CEOs and the compensation chair is of high status relative to other compensation chairs. As was the case at the local comparison level, being a high-status CEO and having a low-status compensation chair has a strong, positive effect on CEO pay ($\beta = .21$, $p < .01$).

These results provide strong support for our social capital hypotheses with regard to status. Furthermore, the significance of our social comparison (logarithm of average compensation committee members' full-time employment salary) and social influence (CEO presence on a board prior to compensation chair's board appointment) variables in models 3 through 10 support our broader social influence arguments. Given that firm performance and human capital are accounted for in these models, the significance of social capital and these two additional social psychological variables is striking.

Although these results do not support our primary conceptualization of social similarity, an additional way to examine social similarity is to consider similarity in status. Social similarity, measured as shared experiences and involvements, does not significantly affect compensation, but models 7 and 10 show that status similarity does significantly influence CEO pay.

TABLE 2
Results of Regression Analysis for CEO Compensation[a]

	Models									
Independent Variables	1	2	3	4	5	6	7	8	9	10
Sales	0.18***	0.18***	0.20***	0.20***	0.21***	0.21***	0.20***	0.18***	0.18***	0.20***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
ROE	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
CEO tenure	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
CEO education	0.02	0.02	0.03	0.03	0.01	0.01	0.03	0.02	0.02	0.03
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)
Compensation committee size	−0.01	−0.01	−0.02	−0.02	−0.02	−0.03	−0.02	−0.02	−0.02	−0.02
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Social comparison	0.11	0.11	0.13*	0.13*	0.14*	0.13*	0.11	0.14*	0.14*	0.12
	(0.08)	(0.08)	(0.07)	(0.07)	(0.07)	(0.07)	(0.08)	(0.07)	(0.08)	(0.07)
Social influence	0.09	0.09	0.13*	0.13*	0.12**	0.12**	0.11*	0.11*	0.11*	0.11*
	(0.06)	(0.06)	(0.06)	(0.06)	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)
Social similarity		0.00		0.00		0.00	0.01		0.00	0.01
		(0.01)		(0.01)		(0.01)	(0.01)		(0.01)	(0.01)
CEO status, global			0.02	0.02						
			(0.01)	(0.01)						
Chair status, global			−0.02*	−0.02*						
			(0.01)	(0.01)						
CEO status > chair status, local					0.16***	0.16***				
					(0.05)	(0.05)				
High CEO/low chair status, local							0.17*			
							(0.08)			
High CEO/high chair status, local							0.08			
							(0.08)			
Low CEO/low chair status, local							0.13*			
							(0.06)			
High CEO/low chair status, global								0.13*	0.13*	0.21**
								(0.06)	(0.06)	(0.08)
High CEO/high chair status, global										0.09
										(0.08)
Low CEO/low chair status, global										0.12*
										(0.06)
Constant	4.62***	4.64***	4.41***	4.42***	4.33***	4.35***	4.47***	4.49***	4.50***	4.43***
	(0.50)	(0.50)	(0.48)	(0.49)	(0.46)	(0.47)	(0.49)	(0.48)	(0.49)	(0.48)
Adjusted R^2	0.57	0.56	0.61	0.60	0.64	0.63	0.59	0.60	0.59	0.61
F	6.27***	5.76***	6.45***	5.95***	7.71***	7.13***	5.56***	6.59***	6.07***	5.88***
df	15,45	16,44	17,43	18,42	16,44	17,43	19,41	16,44	17,43	19,41

[a] Industry dummies are included but not reported. $N = 61$. Standard errors are in parentheses. $*p < .05$, $**p < .01$, $***p < .001$, all one-tailed tests.

Being of similarly low local or global status has a positive and significant effect on CEO compensation ($\beta = .13$, $p < .05$; $\beta = .12$, $p < .05$). Given the mean level of compensation in this sample, a one-standard-deviation increase in global status similarity between a CEO and a compensation committee chair will generate approximately $101,000 more compensation for the CEO.

Overall, these results strongly confirm hypotheses addressing status and suggest that social capital in the form of elite social status affects CEO compensation beyond what economic theory and previous psychological studies have shown. Furthermore, these findings provide evidence that the characteristics of a dyad, and in particular those of the compensation committee chair, may be of the greatest importance for understanding CEO pay.

DISCUSSION

Consistent with our hypotheses, the results presented here indicate that the social capital of a CEO and of the chairperson of his or her firm's compensation committee affect CEO pay when social capital is measured as status (that is, the amount and prestige of social resources). Specifically, when a compensation chair's status is low relative to that of other compensation chairs, or when a CEO possesses more status than his or her compensation chair, the CEO receives more compensation (given controls for firm size, industry, firm performance, and human capital). Social capital was also measured as CEO and compensation chair social similarity (shared affiliations). We found that this dimension of social resources, which could be construed as a measure of the likelihood of direct ties between a CEO and compensation chair, had no effect on pay. Our findings confirm the results of previous research (Ibarra & Andrews, 1993) suggesting that status is likely to have a greater effect on CEO compensation than social similarity.

By answering important questions about the effect of social resources on income attainment among CEOs, this study makes a number of important contributions to the social capital literature. First of all, as Boxman, De Graaf, and Flap (1991) pointed out, much of the research on the relationship between social resources and occupational attainment has focused on job status as its primary or exclusive dependent measure. Although some work explores promotion rates (Burt, 1992) in addition to job characteristics, considerably less attention has been directed at income as a measure of occupational attainment (Boxman et al., 1991; De Graaf & Flap, 1988; Marsden & Hurlbert, 1988; and Meyerson, 1994, are exceptions). The few existing studies on social resources and income attainment may be limited by characteristics of their samples. For example, findings on job status show that the effects of social capital may be greater in the United States than in Europe, but almost all studies of income have used samples consisting exclusively of European managers (Boxman et al., 1991; Meyerson, 1994; see Marsden & Hurlburt, 1988, as an exception). Another study (Meyerson, 1994) examined managerial pay within a sample of firms with lower-than-expected financial returns. We fruitfully explored the social resources argument as it addressed income attainment among a sample of U.S. managers in the same hierarchical position (chief executive), controlling for industry and firm performance.

The second contribution of this study is its examination of the value of social capital when human capital and other potential determinants of pay (such as firm size, industry, and firm performance) are also measured. Studies that have investigated the simultaneous effects of social and human capital (e.g., Boxman et al., 1991) indicate that social capital has an independent effect on job-related outcomes and may be more important than human capital, particularly in the United States (De Graaf & Flap, 1988; Lin et al., 1981; Marsden & Hurlbert, 1988; Useem & Karabel, 1986). Our results confirm that social capital significantly affects income attainment among CEOs even when human capital is accounted for. In fact, we found no evidence for a human capital explanation of CEO pay.

This finding suggests that social capital may be the active ingredient in previous studies of human capital and compensation since social capital is unmeasured in that literature (Hogan & McPheters, 1980). It seems plausible that when the effects of social capital are not controlled, measures of human capital may actually capture its effects. For instance, although many current CEOs have master's of business administration degrees and therefore, high human capital, their educational experience may also serve to increase their social resources by providing an affiliation with a prestigious educational institution and opportunities to build influential personal networks. Our results suggest that among CEOs, the social capital associated with a degree may be more valuable than the gains in human capital it represents.

An additional contribution to social capital research is this study's examination of comparative social capital. The traditional social capital hypothesis is that the more social resources possessed, the better the outcomes. In testing this hypothesis, the social resources of the focal individual are often measured in terms of the job status of a contact or contacts. The social capital possessed by a decision maker (i.e., the influence target) is typically not measured, and the role of relative social capital in generating better outcomes is not considered (D'Aveni & Kesner, 1993, is an exception). Here, we examined the social capital of both a focal individual (a CEO) and an influence target (the compensation committee chair of the CEO's firm) in relation to all sampled executives, their structurally equivalent peers in the sample, and their partners in the CEO-compensation chair dyads.

This study demonstrates that relative social capital may be more important than absolute social capital in predicting managerial behavior. Contrary to the standard social resource hypothesis, the absolute social capital of CEOs (the CEO global status measure) did not affect their remuneration. Although our hypothesis that the compensation chairs' absolute status would affect pay was confirmed, differences in status between the CEO and chair better explained variance in compensation. It seems that CEOs and compensation chairs process the self-relevant information generated through status comparisons in ways that affect relative social influence. This study revealed that although they may compare themselves to structurally equivalent others, understanding the status differences between a CEO and a committee chair, without reference to their separate groups, is sufficient to predict compensation. These results regarding CEO compensation fit with D'Aveni and Kesner's (1993) findings showing that when the managers of a takeover target are of lower status than the outside board members in the bidding firm, the former are more likely to cooperate with the takeover.

Our results suggest that greater attention should be paid to the characteristics of targets of social influence, in this case, compensation committee chairs. One implication of our findings is that a board may be able to limit CEO influence over compensation decisions by selecting a compensation chair of very high status. Research suggests that doing so may be especially important if a CEO has long tenure on a board (Wade et al., 1990). As Wade and colleagues pointed out, "the effects of social influence seem to be an agency cost produced by ineffective monitoring systems" (1990: 601). Our findings are consistent with previous research suggesting that high-status outsiders may be better able to monitor CEOs by curbing opportunism (D'Aveni & Kesner, 1993). It is possible that compensation chairs who serve on many boards and participate in many clubs know more about the performance and compensation of other CEOs and therefore can construct a compensation scheme aligned with firm performance. However, if a purely informational interpretation were correct, models capturing absolute CEO and absolute compensation chair status should explain the same amount of variance as models addressing relative status. Our results demonstrate that the status of a CEO relative to that of a compensation chair explains more variance than the absolute measures, supporting an influence interpretation over a purely informational interpretation.

Resource dependence theory suggests that selecting high-status board members will, in addition to its effects on CEO pay, also enable a firm to secure resources and better manage a changing environment (Burt, 1983; D'Aveni, 1990; D'Aveni & Kesner, 1993; Pfeffer & Salancik, 1978). However, because the potential effects of board member status on CEO compensation via improved firm performance are indirect, there is a powerful incentive for CEOs to select lower-status board members. This may be particularly true in firms performing poorly because the possibility of improving firm performance enough to significantly bolster pay through the selection of high-status board members is a longer-term proposition. Furthermore, the effects of changes in ROE on CEO compensation are variable, reducing the incentive for many CEOs to concentrate on improving their pay through enhanced firm performance (Finkelstein & Hambrick, 1989; Hambrick & Finkelstein, 1995).

However, this study's results do not necessarily imply any conscious manipulation on the part of CEOs. It may be, for instance, that CEOs appoint or approve the appointment of lower-status board members for the purpose of self-enhancement. Since status may affect self-esteem, lower-status, chairs may be more likely to acquiesce to CEOs or to dampen potential disagreements (Ridgeway & Johnson, 1990), indirectly affecting compensation.

Similarly, our findings do not indicate that compensation committee chairs are willfully ignoring information relevant to CEO and firm performance. Instead, it seems plausible that in group decision-making contexts, ambiguous decisions stimulate the use of social information, including social capital (Chaiken, 1980, 1987). The results of this study are consistent with the psychological literature on social influence in that social characteristics of the source are associated with obtaining better outcomes (Cialdini, 1995).

Our findings provide little support for economic theories of human capital or an interpretation of social capital congruent with traditional economic assumptions. For example, economists might argue that CEO social characteristics are valid inputs in the wage equation because, in the absence of measures of human capital and firm performance, social status serves as a proxy for these variables. However, since human capital and firm performance were already indexed in our analyses, social status should not have added explanatory power above and beyond these measures. Furthermore, there is no obvious economic rationale for the significant, positive effects of shared low status on CEO compensation.

Another argument—that CEOs with high social capital receive more pay because their networks benefit their firms—is consistent with resource dependence theory. According to that theory (Pfeffer & Salancik, 1978), corporate interlocks benefit firms by enabling them to "anticipate environmental contingencies and to control [their] relationships with other corporations" (Allen, 1974: 393–394). However, our results show no effect of CEO absolute status, a measure that includes CEO board memberships, or of social similarity, which captures overlaps between CEOs and compensation chairs' boards, in addition to other affiliations. If CEOs' social resources are viewed as benefiting their organizations, one could expect to see much greater returns to CEO absolute status than to the relative status measures that incorporate the seemingly irrelevant data on compensation chair status. We found no effect of CEO absolute status and, instead, powerful effects of relative status. These results support neither a conventional economic argument that CEOs are being rewarded for their human capital nor the resource dependence hypothesis that top executives are compensated for their social capital because it is assumed to improve firm performance over the long term.

Although class coordination and resource dependence theories are increasingly presented as compatible views of boards (Mizruchi & Galaskiewicz, 1993), we find stronger support for a class coordination interpretation of CEO compensation setting. According to resource dependence theory, both the CEO's and compensation chair's status should benefit a firm and, in the context of our study, we should observe CEOs of high status receiving high levels of pay. According to class coordination theory, "interconnected groups within the capitalist class exert control over resource allocation for the benefit of the upper classes" (D'Aveni, 1990: 125). As already discussed, our findings do not support a resource dependence interpretation of CEO social capital, but do provide some support for the class coordination perspective. High-status compensation chairs do seem to curb CEO compensation, protecting the interests of the owner class. However, our results showing that a CEO's pay depends upon the status of the CEO relative to that of his or her compensation chair suggest that a class coordination interpretation is insufficient. High-status CEOs seem to pursue narrow self-interest, rather than the broader interests of the owner class, when paired with low-status compensation chairs.

Our results also suggest that social influence processes facilitated by status comparisons serve as the mechanism through which social capital affects the allocation of CEO compensation. Therefore, our results confirm underlying psychological theory and previous findings regarding the effects of social characteristics on social influence (Chaiken, 1980; Kilduff & Krackhardt, 1994).

Although our findings provide strong support for the status dimension of social capital, this study has several limitations. First, we only examined a small, albeit important, portion of the relevant board-CEO relationships that may be associated with CEO compensation. Future research should examine how the status and similarity of a firm's entire compensation committee affect CEO pay. The similarity and status of the entire board may also be relevant. These investigations were not possible using this study's sample. Future research is needed to determine the effects of these various relationships and to address the contrasting effects of committees and full boards on board decisions.

Related to this point, the cross-sectional nature of this study precludes us from examining important issues of board and committee ascendance. Although this study does not delve into the dynamics of the director selection process itself, other researchers have shown that patterns of director selection may vary over time as a function of firm performance (D'Aveni, 1989). Research on the selection of committee chairs and on general board selection processes seems especially important in light of the increasing use of committees in board decision making (Bacon, 1990; Worthy & Neuschel, 1984). Because we show that the characteristics of compensation committee chairs matter, uncovering the conditions under which high- or low-status directors are selected may be a fruitful area for future research.

Finally, unlike Galaskiewicz and colleagues (1985), we did not test competing dimensions of status embodied in each CEO and compensation chairperson, such as their personal prestige versus the prestige of the firm that employs them (Burt, 1983). Demonstrating the effects of each form of status and status differences on CEO pay would further elucidate the ways in which social capital uniquely affects organizational outcomes.

Overall, the findings of this research demonstrate the importance of social capital as a factor in CEO wage setting. The strength of these effects, independent of more conventional theoretical explanations, suggests that if scholars are to truly understand how executive compensation is determined, their models need to be better grounded in psychological theory and more accurately reflect how boards operate.

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KARASEK'S MODEL IN THE PEOPLE'S REPUBLIC OF CHINA: EFFECTS OF JOB DEMANDS, CONTROL, AND INDIVIDUAL DIFFERENCES

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A study of 1,200 employees from five Chinese cities found support for the cross-cultural applicability of Karasek's job demands–decision latitude model. The highest anxiety and depression were related to high job demands and low control, and the highest job satisfaction and life satisfaction were related to high job demands and high control. However, there were individual differences in the interactive effects of job demands and control and group differences in the applicability of the model, suggesting that Karasek's model needs to be amended and extended to take individual and socioeconomic differences into account.

During the last two decades, job stress has been of particular interest to both academic researchers and practicing managers. Among the studies of the antecedents of stress, Karasek's (1979) job demands–decision latitude model has captured much attention. "Job *demands* are defined as psychological stressors, such as requirements for working fast and hard, having a great deal to do, not having enough time, and having conflicting demands. . . . Job *decision latitude* comprises two components: the worker's authority to make decisions on the job (decision authority), and the variety of skills used by the worker on the job (skill discretion). Operationally these two components are combined into one measure of decision latitude, or control" (Ganster & Schaubroeck, 1991a: 241–232).

The first major prediction of Karasek's model is that stress occurs in "high-strain" jobs that are simultaneously high in demands and low in decision latitude. The second prediction is that positive outcomes, such as satisfaction, motivation, and healthful regeneration, occur when jobs are high in both demands and decision latitude, constituting what Karasek (1797) termed "active jobs." Jex and Beehr explained the theoretical rationale underlying the job demands–job control model: "Job demands put the employee into an aroused or motivated state. If this aroused or motivated

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state is accompanied by low decision latitude or control over the job, this arousal will not be released in the normal execution of the job. It is this non-release, according to Karasek, which leads to negative psychological and physical consequences" (1991: 322). The job demands–control model has dominated the literature of occupational epidemiology concerned with work stress (Kristensen, 1989). It has also provided an appealing theoretical basis for stress research in the organizational sciences (e.g., Dwyer & Ganster, 1991; Fox, Dwyer, & Ganster, 1993; Martin & Wall, 1989; Spector, 1987; Tetrick & LaRocco, 1987; Warr, 1987). Many reviewers (e.g., Ganster, 1989; Jex & Beehr, 1991; Sauter, Hurrell, & Cooper, 1989) have summarized the knowledge derived from tests of the model and the deficiencies that need to be addressed.

First, the greatest support for the model has been obtained in occupation-level analyses, in which jobs characterized by high demands and low control were found to be associated with the highest stress. For instance, Karasek (1979) analyzed national survey results from both U.S. and Swedish populations. He found that individuals in occupations with high demands and low decision latitude suffered the most severe psychosomatic complaints and the highest levels of both depression and job and life dissatisfaction. Later, Karasek, Baker, Marxer, Ahlbom, and Theorell (1981) found that a combination of high demands and low control was related to high levels of cardiovascular disease. Studies that examined these interactive effects at the individual level of analysis, however, have not yielded much supporting evidence (Hurrell & McLaney, 1989; Spector, 1987). Since jobs are in many ways unique to job incumbents, it is questionable whether occupation-level analysis is appropriate for research on psychological stress. Ganster and Schaubroeck (1991a) argued that aggregating individual responses to the occupational level eliminates a great deal of the true variability that exists within occupations, thus making it very difficult to detect the real interactions between job demands and control.

Second, the demands-control model focuses on the interaction between these two environmental stimuli, but it does not deal directly with the interaction between person and environment. Surprisingly little seems to be known about how individual differences affect the interaction between job demands and control. Rather, an implicit assumption of general applicability underlies the model. In a subsequent study, Karasek (1989) did allude to new theoretical developments intended to make the model a more dynamic description of the process of person-environment interaction. However, so far not much has been done to pursue these ideas or to devise appropriate empirical tests for them.

Third, there is no consistent statistical evidence for the interaction between job demands and control. The early studies (e.g., Karasek et al., 1981) seemed to support an additive model rather than an interactive one. Further tests have yielded mixed results. For instance, Dwyer and Ganster (1991), Fox, Dwyer, and Ganster (1993), Martin and Wall (1989), and Warr (1987) provided evidence for the interactive effects of job demands and control (or heavy responsibility), but Spector (1987) and Tetrick and LaRocco (1987) did not. The underlying reasons for the inconsistent findings have not been systematically examined. Ganster and Schaubroeck (1991a) suggested that individual characteristics of respondents, which have been largely overlooked in this field, have potentially confounded the results of studies.

Fourth, research on Karasek's model has been centered in North America and Europe, whose cultures have been designated as typically individualist (Hofstede, 1991). Research on the generalizability of the model in cultures with a more collective orientation has been extremely limited. Yet, it is important to determine whether the model is unique to Westerners or applies also to non-Westerners. The context in which organizations are embedded has changed tremendously in recent years. Today, the emergence of a competitive global business environment has challenged businesses to understand, communicate, and motivate people from other cultures. Cross-cultural research on similarities and differences in human attitudes and behavior, particularly research on the generalizability of Western theories of management and organizational behavior, is essential if organizations are to cope effectively with these challenges.

The present study was the first to extend Karasek's job demands–control model to the People's Republic of China, a society that is culturally different from those that have been studied thus far. As Shenkar and Von Glinow (1994) pointed out, China is an ideal site for testing the generalizability of Western organizational theories. Because China differs substantially from the West on many contextual variables, including culture, society, politics, and economic system, it provides a serious challenge for tests of Western paradigms. China has the largest workforce in the world and plays an increasingly important role in the world economy. It is imperative to explore the transportability of Western managerial theories and practice to China and to pinpoint the differences between China and the West. Karasek's model is a fundamental theory of job stress that hinges on the psychological role that personal control plays in determining how individuals respond to the demands of their jobs.[1] Extending this model to China provides valuable insights into the similarities and differences between people from collectivist and individualist cultures.

The present study has two objectives. The first was to explore the cross-cultural generalizability of the job demands–control model by looking at its applicability to the People's Republic of China. The second was to extend the model by probing the role of individual differences in the interaction between job demands and control.

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[1] I owe this point to an anonymous reviewer.

THEORY AND HYPOTHESES

Applicability of Karasek's Job Demands–Control Model to China

Multicultural comparative research has designated Chinese culture as typically collectivist (Hofstede, 1991). Moreover, according to Hofstede, Chinese culture has much higher ratings than Western cultures on power distance, a cultural dimension reflecting the extent to which the less powerful members of a society expect and accept that power is distributed unequally. Essential aspects of the Confucian heritage—the Five Cardinal Relations (wu lun) and the Rules of Correct Behavior (li)—emphasize the respect for hierarchic order and age (Bond & Hwang, 1986). Specifically, Confucianism sets out three principles of interpersonal relationships and obligations: an older person has more rights than a younger one, a man has more rights than a woman, and a superior has more rights than a subordinate. In other words, Chinese traditional values reinforce the subservience of subordinates and their dependence on superiors, and they give little importance to personal control (Laaksonen, 1988). Because valuing personal control is more likely to be a feature of an individualist culture than of a collectivist one, Karasek's model would, at first glance, appear not to be applicable in China.

However, this observation presupposes that culture is the sole determinant of human attitudes and behavior, and a static one at that. Yet researchers know that the environment, which affects culture and is affected by it, potentially reinforces, shapes, and even radically alters cultural patterns (Triandis, 1972). Thus, in the 20th century, political and social conditions have, in many ways, strengthened the desire of Chinese employees for personal control over their workplaces. Worker participation has always been popular in modern China. It was consistent with the socialist ideology that prevailed before the current economic reform, and it has also proved to be fully compatible with the theme of democratic management that emerged during the reform (Jamal & Xie, 1991; Laaksonen, 1984; Nelson & Reeder, 1987). Moreover, the economic reform has greatly stimulated competition and strengthened the tendency of individuals to promote their self-interests. Recent studies (e.g., Chen, 1996) have shown that Chinese employees are economically oriented and prefer to link rewards to individual performance, reflecting values that are incongruent with the traditional ones. Altogether, these factors point to the generalizability of Karasek's model to China.

Shweder and Sullivan suggested that the perception of self is a typical example of universal mental functioning: "Although the boundaries between internal and external may vary in scope and permeability across cultural communities, the concept of an individuated person or self is widely distributed across a broad range of cultural and informational environments" (1993: 514). The desire for personal control over the environment is a manifestation of the perception of self. Thus, the fundamentals of Karasek's model would generalize in different cultures to a greater or lesser extent. This study probed the extent to which the interactions between job demands and control influence the anxiety, depression, health problems, and satisfaction of Chinese employees. I tested four hypotheses derived from Karasek's (1979) demands-control model.

> *Hypothesis 1: Job demands will be positively associated with employee anxiety, depression, and psychosomatic health problems. Control will be negatively related to anxiety, depression, and psychosomatic health problems.*
>
> *Hypothesis 2: Job demands and control will have interactive effects on employee anxiety and depression. The highest levels of anxiety and depression will occur when job demands are high and control is low.*
>
> *Hypothesis 3: Job demands and control will have an interactive effect on employee health. The highest level of psychosomatic health problems will occur when job demands are high and control is low.*
>
> *Hypothesis 4: Job demands and control will have interactive effects on employee job satisfaction and life satisfaction. The highest level of satisfaction will occur when job demands are high and control is high.*

Individual Differences in the Interaction of Job Demands and Control

This study also explored the role of individual differences in the interaction of job demands and control. Asking the question, Do the effects of active and high-strain jobs predicted in Karasek's model apply uniformly?, I sought to determine which individuals are more likely to appreciate, pursue, and obtain personal control in the workplace. It is to these individuals that Karasek's model would particularly apply.

According to Karasek's model, individuals who have high control will tolerate aversive events better than those who do not. However, prior research has suggested that there is no "ideal" level of either demands or control that fits all individuals equally. It is well documented that individuals prefer different levels of environmental demands, because of variations in education, job tenure (Schuler, 1980), perception of the fit between their ability and job (Abdel-Halim, 1981), self-esteem (Ganster & Schaubroeck, 1991b), hardiness and locus of control, and type A behavior (Ganster & Schaubroeck, 1991a). Although individual differences in preferred levels of decision latitude have not been extensively researched, researchers know that some people find decision latitude to be more desirable than others do. For instance, individuals who espouse the so-called Protestant ethic have a strong desire for personal control over their work environments (Hulin & Blood, 1968). People who have a high need for personal growth and development respond more positively to jobs that are high in complexity than people with low "growth need strength" (Hackman & Oldham, 1976). Given these individual differences, it is plausible to question whether control plays the same buffering role for all individuals.

A major theoretical rationale underlying this study's exploration of individual differences was the person-environment (P-E) fit model of stress (Caplan, Cobb, French, Van Harrison, & Pinneau, 1975), which suggests that stress results from a lack of fit between (1) environmental supplies and personal values, goals, and motives and (2) environmental demands and personal abilities and skills. French, Caplan, and Van Harrison (1982) confirmed that stress resulted from various forms of misfit between people and their jobs, including excessive environmental demands, insufficient environmental supplies, or both. Although both subjective and objective indicators of P-E fit are available, French and colleagues (1982) asserted that the former is a stronger predictor of stress. The present study extended Karasek's model by integrating the broad notion of P-E fit. It explored the effects of a subjective indicator of P-E fit—an individual's perception of the fit between his or her ability and job (ability-job fit)—on the interaction of job demands and control.

According to the P-E fit model of stress, whether a given level of job demands is stressful to a job holder is determined by his or her ability (or perceived ability) to perform the job (Caplan et al., 1975; Edwards & Cooper, 1990). Thus, Karasek's model would apply better to individuals with perceived ability-job fit than to those without such fit. Abdel-Halim (1981) reported a moderating effect of ability-job fit on the relationship between role ambiguity/role conflict and job satisfaction. Xie and Johns (1995) found that people with complex jobs who perceived themselves as having ability-job fit experienced less exhaustion and anxiety than those perceiving a lack of fit. These findings revealed that individuals without perceived ability-job fit are more vulnerable to job demands than those with such fit.

More important, the major assumption of Karasek's model, that a high level of personal control would alleviate the arousal resulting from job demands, would apply only to those who consider control as a factor reducing stress. Individuals without perceived ability-job fit would have a higher propensity than those with the fit to view high control as stressful rather than as stress reducing. Brockner's (1988) concept of "behavioral plasticity" can be used to explain the role of perceptions of ability-job fit in relationships between environmental stimuli and employee responses. People with lower self-esteem tend to be more yielding to external cues. They are therefore more behaviorally plastic (reactive) than those with high self-esteem (Brockner, 1988). Building on this idea, I would expect people who perceive a lack of ability-job fit to need more external support and less independence when performing their jobs than those with the fit. Since decision latitude bestows decision authority and skill discretion on workers (Karasek, 1979), it is likely to escalate the level of arousal for those without ability-job fit.

Furthermore, control would play the buffering role predicted by Karasek only if a job holder needs it or it is obtainable. Some longitudinal studies have suggested a reciprocal relationship between an individual's perceived ability and the level of control he or she needs or obtains (e.g., Kohn & Schooler, 1982; Mortimer & Lorence, 1979). That is, individuals with low self-confidence tend to have a low expectation for personal control. Such people in turn generally receive less control, which in turn further lowers their self-confidence. This tendency was expected to lower the moderating effects of control for those without perceived ability-job fit. Thus,

> *Hypothesis 5: The two main predictions of Karasek's model—that the interaction of high demands and low control leads to high stress and that the interaction of high demands and high control leads to high satisfaction—will be more applicable to individuals who perceive themselves as having ability-job fit than to those who perceive a lack of fit.*

Karasek's model was also expected to apply better to white-collar workers than to blue-collar workers in China. There are subtle differences between these two occupational groups in education, social status, exposure to Western influences, and level and type of personal control granted at work. These differences, in turn, should influence the extent to which traditional values are upheld. In comparison to white-collar workers, Chinese blue-collar workers are generally less educated and less exposed to Western influences. Therefore, they are more likely to maintain the traditional values, which impede the desire of individuals for personal control.[2] In addition, job holders with lower education and lower job scope are likely to have less control at work (Ganster & Schaubroeck, 1991a). Although research directly comparing the need for control of Chinese blue- and white-collar workers is scarce, some Chinese studies have revealed a tendency of blue-collar workers to feel little need for personal control at work. For instance, many blue-collar workers considered that the most attractive feature of their jobs was "saving worry derived from mental demands and responsibility" (cf. *Beijing Youth News,* 1994). Drawing on the notion of P-E fit and stress (Caplan et al., 1975), one can hypothesize that control may actually provoke stress when it is not valued, since stress results from a misfit between environmental supplies and personal values, goals, and motives.

The type of control posited in Karasek's model is job- or operation-related. Chinese blue-collar workers, however, have control mainly over issues that relate only indirectly to their jobs (for example, the implementation of a birth control policy). Often, they also participate in making certain decisions at lower levels of organizations, including evaluation of co-workers' performance, and the election of workshop managers (Xie, 1995). As Von Glinow and Teagarden (1988) pointed out, more substantive control over operation-related issues is confined to managers and bureaucrats. Therefore, Karasek's model would apply less well to blue-collar workers.

The political, social, and economic environments of blue-collar workers in contemporary China might have further reduced their concerns for personal control at work. Blue-collar workers in state-owned enterprises used to enjoy high social status and economic security when the socialist ideology prevailed throughout the country (Laaksonen, 1984), but they have lost their political and economic advantages under the market system that has emerged during the economic reform. Many workers in less prosperous enterprises now receive only a small proportion of their previous salaries. Moreover, recent studies (cf. *World Daily,* 1995) have revealed that blue-collar jobs have the lowest ratings in occupational prestige and social status. The "iron bowl" (a Chinese term for life-long employment) is breaking, and an alternative system to absorb excess labor has yet to develop. As a result, blue-collar workers are the most vulnerable social group in this period of rapid change. Because of their limited education and specialized production skills, they have had many fewer opportunities than white-collar workers for job advancement and mobility. During my discussions with Chinese people from various occupations, many blue-collar workers reported experiencing very high stress, which they attributed to lost job security, decreased incomes, increased job demands, and the requirement to learn new skills resulting from organizational changes. Personal control at work did not appear to be a stress-reducing factor. Drawing on Maslow's (1970) theory of hierarchy of needs, I expected that Chinese blue-collar workers would have a higher propensity than white-collar workers to seek satisfaction of their lower-level needs. Less concrete issues such as control at work might not be compelling for them. Thus,

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[2] I owe this point to an anonymous reviewer.

> *Hypothesis 6: The two main predictions of Karasek's model—that the interaction of high demands and low control leads to high stress and that the interaction of high demands and high control leads to high satisfaction—will be more applicable to white-collar workers than to blue-collar workers.*

METHODS

Respondents and Procedures

A survey was conducted in the summer of 1994. Full-time Chinese employees of numerous state-owned organizations provided questionnaire data. The response rate was 70 percent, a figure representing 1,200 respondents. Participation in the survey was voluntary, and the confidentiality of responses was guaranteed. The questionnaires were completed during the respondents' leisure time. The average respondent was 34 years old and had 13 years of education and 11 years of work experience. Fifty-eight percent of them were men.

On the first page of the questionnaire, each respondent was asked to provide his or her job title and to indicate to which occupational group he or she belonged. This study adopted the categories of the occupational groups from the 1992 Chinese Census, which classifies all employed individuals as either workers, managers, professionals, public servants (government officials), commercial and service providers (such as salespeople), military personnel, self-employed individuals, and others. The 1,200 respondents represented more than 200 job titles and six groups: blue-collar workers (n = 440), managers (n = 290), professionals (n = 225), public servants (n = 132), commercial and service providers (n = 28), and others (n = 85).

Chinese people in various provinces and regions are remarkably heterogeneous in values and socioeconomic status (Barnard & Shenkar, 1993). To enhance the representativeness of the sample, I collected the data in five cities: Beijing (n = 190), Wuhan (n = 497), Shenzhen (n = 143), Tianmen (n = 86), and Yueyang (n = 284). People from Beijing were more collective in their outlook than those from Wuhan (Huo & Randall, 1991). Shenzhen, the first and most advanced Special Economic Zone[3] in China, is uniquely exposed to Western influences (Barnard & Shenkar, 1993). Tianmen and Yueyang are medium-sized cities in Hubei and Hunan provinces, respectively. They were selected to represent the rural or inland areas in contrast to large cities such as Beijing and Wuhan and coastal cities such as Shenzhen.

The data were collected from numerous organizations, because the predictors of the study, particularly the levels of decision latitude, are determined not only by job design, but also by organizational variables, such as managerial style and organizational culture. As Nelson and Reeder (1987) pointed out, although worker participation has been addressed in China, how well it actually functions depends on the personal inclinations of the managers who are in charge of an enterprise. Selecting a sample from numerous organizations was expected to reduce this bias.

Measures

The conventional method of back-translation (Brislin, Lonner, & Thorndike, 1973) was used to translate the measures from English to Chinese. Because some Chinese organizational researchers have expressed concerns about the potential drawbacks of the back-translation method (Wang, 1993), I and two Chinese organizational specialists discussed and verified each translated questionnaire item to assure its clarity.

Job demands and decision latitude. Karasek's (1979) measures of job demands and decision latitude (control) were used in the present study. The alpha reliability coefficients were .79 for the measure of job demands and .77 for control. Karasek (1979) indicated that job demands and control are constructs that can vary independently in a work environment. I verified the dimensionality of these two variables by a factor analysis. The items measured demands and control loaded on two factors exactly as suggested.

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[3] Special Economic Zones were established by the Chinese government as experimental areas for economic reform. The zones benefit from special government policies that encourage investment.

Anxiety and depression. The measure of anxiety used in this study was developed by Parker and DeCotiis for assessing "job-related feelings of anxiety" (1983: 169). Its coefficient alpha was .81. Depression was measured with the short version of Wheaton's instrument (1991). Its coefficient alpha was .82. A factor analysis provided clear evidence for the dimensionality of anxiety and depression.

Psychosomatic health problems. I assessed psychosomatic health problems by adopting measures from a well-known study of worker health conducted in Michigan (Caplan et al., 1975). Health problems examined in this study included headaches, trouble falling asleep, upset stomach, gas or bloated feelings, loss of appetite, inability to relax, trembling hands, and back pain. The alpha reliability of the measure was .86.

Satisfaction. Hoppock's (1935) three-item measure of job satisfaction, which has a seven-point response scale, was used. The psychometric properties of the measure have been verified (McNichols, Stahl, & Manley, 1978). Its coefficient alpha with the present data was .72. Life satisfaction was measured by a single item developed by Jamal (1976): "Which of the following sentences describes your feelings about life most accurately?" The responses were "I am completely satisfied with my life," "I am rather satisfied with my life," "I am neither dissatisfied nor satisfied with my life," "I am rather dissatisfied with my life," and "I am completely dissatisfied with my life."

Altogether, this study included five outcome variables: anxiety, depression, psychosomatic health problems, job satisfaction, and life satisfaction. I subjected all items measuring these variables to a factor analysis to test the distinctiveness of the respondent-reported constructs. The results provided good evidence for a five-factor structure.

Perceived ability-job fit. Abdel-Halim's (1981) five-item measure of perceived ability-job fit was used. The responses to the measure were on a five-point scale. The items are: "I feel that my work utilizes my full abilities," "I feel competent and fully able to handle my job," "My job gives me a chance to do the things I feel I do best," "I feel that my job and I are well-matched," and "I feel I have adequate preparation for the job I now hold." The reliability of this measure was .73. I verified the dimensionality of perceived ability-job fit, decision latitude, and job demands with a factor analysis. The items measuring ability-job fit did not have any mixed loadings with the items measuring decision latitude or demands.

Control variables. This study employed three groups of control variables in all tests of interactions (Hypotheses 2–6). The demographic variables controlled were gender, age, and education. I used dummy variables (Cohen & Cohen, 1983) for the five cities to control for the possible impact of environmental factors on the results.

The economic reform in China has caused uneven development among state-owned enterprises. There is a growing discrepancy among the enterprises in terms of the salaries, bonuses, and fringe benefits they provide for their employees. Inequality of income, in turn, has led to high stress among the employees of less prosperous enterprises. To deal with this effect, this study included enterprises with a wide range of profitability. Moreover, it added two questionnaire items to control for the variations caused by inequality of income. One item was "Please compare the levels of salary, bonus, and fringe benefits that your company has provided to employees with those of the average company in the same industry." The responses were based on a five-point scale ranging from "much lower than the average level of the industry" (1) to "much higher than the average level of the industry" (5). The other item was "All things considered, please circle one of the following sentences that best expresses your feelings about your current income." The responses were based on a three-point scale ranging from "my income is not sufficient for satisfying the basic needs" (1) to "my income is well sufficient for satisfying my needs" (3). The former item was called *comparative income* and the latter was called *adequacy of income.*

RESULTS

Table 1 presents means, standard deviations, alpha reliability coefficients, and correlations for the variables. Hypothesis 1 predicts that job demands will be positively associated with employee anxiety, depression, and psychosomatic health problems and that control will be negatively related to these variables. The measure of job demands was positively related to anxiety ($r = .35$, $p < .01$) and psychosomatic health problems ($r = .17$, $p < .01$). It was not related to depression. Control was negatively related to anxiety, depression, and psychosomatic health problems (correlations ranged from $-.12$ to $-.27$, $p < .01$). Thus, findings almost fully supported Hypothesis 1.

Interactive Effects of Job Demands and Control

Hypotheses 2 through 4 concern the interactive effects of job demands and control. I used moderated hierarchical regression analysis (Evans, 1991) to test these hypotheses. Hypothesis 2 states that job demands and control will have interactive effects on employee anxiety and depression. The results revealed that job demands and control interactively affected employee anxiety ($\Delta R^2 = .010$, $F_{1,1049} = 13.77$, $p < .001$) and depression ($\Delta R^2 = .010$, $F_{1,1006} = 11.98$, $p < .001$). The highest anxiety and depression occurred when job demands were high and control was low. Specifically, a positive relationship between job demands and anxiety or depression occurred for those with low control. The relationship was relatively flat for those with high control. Thus, Hypothesis 2 was supported.

Hypothesis 3 predicts that the highest level of psychosomatic health problems will occur when job demands are high and control is low. Job demands and control had an interactive effect on employees' psychosomatic health problems ($\Delta R^2 = .007$, $F_{1,990} = 7.81$, $p < .01$). The direction of the interaction, however, was inconsistent with the prediction. A slightly positive relationship between job demands and health problems was found for

TABLE 1
Descriptive Statistics and Correlations for the Variables[a,b]

Variables	Mean	s.d.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Job demands	2.95	0.72	.79													
2. Control	3.07	0.73	.25	.77												
3. Anxiety	2.57	1.36	.35	−.13	.81											
4. Depression	1.91	0.43	.03	−.27	.38	.82										
5. Health problems	2.83	0.88	.17	−.12	.44	.37	.86									
6. Job satisfaction	4.37	1.15	−.02	.32	−.23	−.39	−.11	.72								
7. Life satisfaction	2.86	1.01	.02	.12	−.12	−.34	−.11	.27								
8. Perceived ability-job fit	3.62	0.70	.17	.38	−.13	−.30	−.11	.39	.22	.73						
9. Occupation	1.63	0.48	.05	.32	−.13	−.14	−.15	.21	.04	.14						
10. Gender	1.40	0.49	−.09	−.16	.01	.06	.08	.03	.01	−.03	−.02					
11. Education	13.09	2.48	.11	.29	−.10	−.11	−.17	.06	−.04	.08	.52	−.09				
12. Age	34.35	10.02	.03	.17	−.01	−.11	.01	.23	.16	.25	.16	−.13	.03			
13. Tenure	10.86	9.44	.04	.08	.01	−.08	.06	.16	.14	.17	−.01	−.04	−.09	.64		
14. Comparative income	2.45	1.01	.05	.12	−.03	−.11	−.03	.03	.05	.08	−.01	−.01	.02	.03	.04	
15. Adequacy of income	1.92	0.67	−.01	.24	−.18	−.27	−.14	.27	.20	.19	.17	−.04	.12	.21	.11	.22

[a] $N = 1{,}200$; gender was coded 1 for men, 2 for women; occupation was coded 1 for blue-collar workers, 2 for white-collar workers; reliabilities (coefficient alpha) are on the diagonal.

[b] For correlations greater than or equal to .07, $p < .05$; for $r \geq .10$, $p < .01$.

those with high control. The relationship was flat for those with low control. Therefore, Hypothesis 3 was not confirmed.

Hypothesis 4 states that the highest levels of job satisfaction and life satisfaction will occur when job demands and control are both at high levels. Consistent with the prediction, job demands and control had interactive effects on job satisfaction ($\Delta R^2 = .011$, $F_{1,1067} = 14.82$, $p < .001$) and life satisfaction ($\Delta R^2 = .006$, $F_{1,1067} = 7.03$, $p < .05$). In both cases, a positive relationship between job demands and satisfaction occurred for those with high control, and a negative relationship occurred for those with low control. The highest satisfaction occurred under conditions of high demands and high control. Thus, findings supported Hypothesis 4.

Individual Differences in the Interactions of Job Demands and Control

Hypothesis 5 predicts that Karasek's model will apply better to individuals who perceive ability-job fit than to those who perceive a lack of fit. I performed a three-way moderated hierarchical regression analysis (Cohen & Cohen, 1983) to test the interactive effects of job demands, control, and ability-job fit on all outcome variables. In this analysis, the control variables were entered first, followed by job demands, decision latitude, and ability-job fit. Then came the two-way interactions and, finally, the three-way interaction term. A three-way interaction with a value for p up to .05 was considered statistically significant. Whenever significance appeared, I examined the shape of the interaction separately for individuals who rated high on ability-job fit and those who rated low on it. Table 2 presents the results obtained from the tests of the three-way interactions.

Job demands, control, and ability-job fit interactively affected anxiety ($\Delta R^2 = .037$, $F_{1,972} = 51.89$, $p < .001$), depression ($\Delta R^2 = .019$, $F_{1,972} = 23.66$, $p < .001$), health problems ($\Delta R^2 = .006$, $F_{1,959} = 6.59$, $p < .05$), and life satisfaction ($\Delta R^2 = .022$, $F_{1,972} = 24.72$, $p < .001$). Their interactive effect on job satisfaction was nonsignificant ($\Delta R^2 = .001$, $F_{1,972} = 1.30$, n.s.).

For the psychological variables (anxiety, depression, and satisfaction), Karasek's model was shown to apply better to individuals with ability-job fit than to those without it. For respondents who perceived ability-job fit, a steeply positive relationship between demands and anxiety and depression occurred for those with low control. The relationship was negative for those with high control. The directions of the interactions observed from those without ability-job fit were almost the opposite, with high anxiety and depression occurring when job demands and control were high.

The joint effects of demands, control, and ability-job fit on life satisfaction provided further support for Hypothesis 5. Respondents who combined perceived ability-job fit with high control demonstrated a positive relationship between job demands and satisfaction; for those with low control, the relationship was negative. The interactive effects observed for those without perceived ability-job fit were inconsistent with Karasek's prediction. A positive relationship between demands and satisfaction occurred for those with low control, and a negative relationship occurred for those with high control.

TABLE 2
Results of Regression Analysis of Interactions of Job Demands, Decision Latitude, and Ability-Job Fit[a]

Step	Predictors	β	R^2	ΔR^2	*df*
	Anxiety				
1	Control variables		.097		10,979
2	Job demands	0.75***			
	Decision latitude	−0.23***			
	Perceived ability-job fit	−0.26***	.244	.147***	3,976
3	Demands × latitude	−0.20*			
	Latitude × ability-job fit	0.37***			
	Demands × ability-job fit	−0.04	.270	.026***	3,973
4	Demands × latitude × ability-job fit	−1.42***	.307	.037***	1,972
	Depression				
1	Control variables		.105		10,979
2	Job demands	0.07***			
	Decision latitude	−0.10***			
	Perceived ability-job fit	−0.14***	.189	.084***	3,976
3	Demands × latitude	−0.03			
	Latitude × ability-job fit	0.01			
	Demands × ability-job fit	−0.07**	.200	.011**	3,973
4	Demands × latitude × ability-job fit	−0.32***	.219	.019***	1,972
	Health problems				
1	Control variables		.059		10,966
2	Job demands	0.29***			
	Decision latitude	−0.10			
	Perceived ability-job fit	−0.13**	.115	.056***	3,963
3	Demands × latitude	0.16*			
	Latitude × ability-job fit	0.08			
	Demands × ability-job fit	−0.02	.126	.011**	3,960
4	Demands × latitude × ability-job fit	0.33*	.132	.006*	1,959
	Job satisfaction				
1	Control variables		.133		10,979
2	Job demands	−0.14**			
	Decision latitude	0.31***			
	Perceived ability-job fit	0.47***	.261	.128***	3,976
3	Demands × latitude	0.11			
	Latitude × ability-job fit	0.01			
	Demands × ability-job fit	0.08	.266	.005	3,973
4	Demands × latitude × ability-job fit	−0.16	.267	.001	1,972
	Life satisfaction				
1	Control variables		.074		10,979
2	Job demands	−0.01			
	Decision latitude	0.05			
	Perceived ability-job fit	0.26***	.108	.034***	3,976
3	Demands × latitude	0.02			
	Latitude × ability-job fit	0.02			
	Demands × ability-job fit	0.10	.111	.003	3,973
4	Demands × latitude × ability-job fit	0.82***	.133	.022***	1,972

[a] Predictors are grouped under outcome variables. The controls were (1) demographic variables (gender, age, job tenure, and education), (2) environmental variables (comparative income and adequacy of income), and (3) dummy variables for cities.

* $p < .05$

** $p < .01$

*** $p < .001$

The results involving health problems, however, contradicted Hypothesis 5. For individuals who perceived ability-job fit, the relationship between job demands and health problems was positive for those with high control and negative for those with low control. These interactive effects were just the opposite for individuals without perceived ability-job fit. In other words, for psychosomatic health problems, Karasek's model was found to apply better to those without perceived ability-job fit.

Hypothesis 6 predicts that Karasek's model will apply better to white-collar workers than to blue-collar workers. To establish the general patterns of similarities and differences between blue- and white-collar workers, I first conducted a Scheffé test to compare the mean responses of the blue-collar group and the three white-collar groups (managers, professionals, and public servants) on all variables under examination. This analysis did not include the commercial and service providers ($n = 28$) and those from the group "others" because I did not have enough information to categorize these respondents as either blue-collar or white-collar workers. The blue-collar workers had significantly lower decision latitude (mean = 2.76, s.d. = 0.66) than the managers (mean = 3.29, s.d. = 0.66), professionals (mean = 3.33, s.d. = 0.66), and public servants (mean = 3.17, s.d. = 0.77; $F_{3,1023} = 50.83$, $p < .001$). However, the standard deviations were identical for the blue-collar workers, professionals, and managers, which would seem to indicate that restriction of range was not a critical issue for the blue-collar workers.

Consistent with findings reported in Canada (e.g., Xie & Johns, 1995), the Chinese blue-collar workers experienced significantly higher stress and lower satisfaction than the white-collar workers. Specifically, Chinese blue-collar workers reported higher anxiety ($F_{3,1049} = 8.74$, $p < .001$), higher depression ($F_{3,1007} = 9.24$, $p < .001$), lower job satisfaction ($F_{3,1067} = 19.23$, $p < .001$), and lower adequacy of income ($F_{3,1072} = 12.71$, $p < .001$) than did managers, professionals, and public servants. Furthermore, they had more health problems than professionals and public servants ($F_{3,990} = 8.58$, $p < .001$). The only perceptual variables on which the blue-collar workers did not differ from the others were job demands and life satisfaction. The only variation that occurred among the white-collar groups was on life satisfaction: professionals were less satisfied with their lives than public servants ($F_{3,1077} = 4.08$, $p < .01$). These findings provided clear evidence that there were consistent differences between blue- and white-collar workers but that the three white-collar groups were basically alike.

Table 3 presents the means, medians, and levels of skewness of the demographic variables. Blue-collar workers had the lowest level of formal education (median = 12 years), and the professionals had the highest (median = 16 years; $F_{3,1013} = 182.23$, $p < .001$). The blue-collar workers were younger (median = 30 years) than the professionals (median = 32 years) and managers (median = 37 years; $F_{3,1013} = 16.05$, $p < .001$). The managerial group was more dominated by men than the other groups ($F_{3,1056} = 8.59$, $p < .001$). No differences were found in job tenure ($F_{3,1056} = 0.31$, n.s.). There

TABLE 3
Demographic Characteristics of the Sample[a]

Occupational Group	*n*	Mean	Median	Skewness
Blue-collar workers	440			
Education		11.42	12	−0.47
Age		32.45	30	1.13
Gender		1.41	1	0.38
Job tenure		10.87	9	0.86
Managers	290			
Education		13.74	15	−0.37
Age		37.40	37	0.17
Gender		1.26	1	1.08
Job tenure		10.57	7.6	1.61
Professionals	225			
Education		15.10	16	−0.98
Age		35.70	32	0.72
Gender		1.46	1	0.16
Job tenure		11.94	9.5	1.02
Public servants	132			
Education		13.93	15	−0.33
Age		34.39	35	0.40
Gender		1.44	1	0.25
Job tenure		10.40	8	1.83
Entire sample	1,087			
Education		13.09	12	−0.23
Age		34.35	33	0.66
Gender		1.40	1	0.54
Job tenure		10.86	8	1.81

[a] Gender was coded man = 1; woman = 2.

is some skewness in these variables, particularly job tenure. Nevertheless, the distributions of all four groups were skewed in the same direction.

Hypothesis 6 was tested by using three-way moderated hierarchical regression analysis. I used a variable called occupation to distinguish between blue- and white-collar workers (blue-collar workers were coded as 1 and white-collar workers were coded as 2). The interactions of job demands, control, and occupation significantly accounted for variance in all outcome variables. Specifically, job demands, control, and occupation interactively affected anxiety ($\Delta R^2 = .028$, $F_{1,980} = 37.97$, $p < .001$), depression ($\Delta R^2 = .012$, $F_{1,979} = 14.29$, $p < .001$), health problems ($\Delta R^2 = .011$, $F_{1,959} = 12.09$, $p < .001$), job satisfaction ($\Delta R^2 = .005$, $F_{1,979} = 6.27$, $p < .05$), and life satisfaction ($\Delta R^2 = .005$, $F_{1,978} = 5.39$, $p < .05$). Table 4 presents the results.

All interactions detected in the data from white-collar workers fit the predictions of Karasek's model. That is, the highest levels of anxiety, depression, and health problems observed occurred under conditions of high job demands and low decision latitude, and the greatest satisfaction occurred when jobs were high in both demands and decision latitude. The

TABLE 4
Results of Regression Analysis of Interactions of Job Demands, Decision Latitude, and Occupation[a]

Step	Predictors	β	R^2	ΔR^2	*df*
	Anxiety				
1	Control variables		.097		10,987
2	Job demands	0.73***			
	Decision latitude	−0.30***			
	Occupation	−0.12	.231	.134***	3,984
3	Demands × occupation	0.18			
	Latitude × occupation	0.18			
	Demands × latitude	−0.30***	.242	.011**	3,981
4	Demands × latitude × occupation	−1.13***	.270	.028***	1,980
	Depression				
1	Control variables		.105		10,986
2	Job demands	0.06**			
	Decision latitude	−0.14***			
	Occupation	0.004	.151	.046***	3,983
3	Demands × occupation	0.11*			
	Latitude × occupation	−0.04			
	Demands × latitude	−0.11***	.166	.015***	3,980
4	Demands × latitude × occupation	−0.23***	.178	.012***	1,979
	Health problems				
1	Control variables		.059		10,966
2	Job demands	0.28***			
	Decision latitude	−0.13**			
	Occupation	−0.09	.108	.049***	3,963
3	Demands × occupation	0.06			
	Latitude × occupation	−0.10			
	Demands × latitude	0.13*	.116	.008*	3,960
4	Demands × latitude × occupation	−0.47**	.127	.011***	1,959
	Job satisfaction				
1	Control variables		.133		10,986
2	Job demands	−0.10**			
	Decision latitude	0.42***			
	Occupation	0.25**	.203	.070***	3,983
3	Demands × occupation	−0.05			
	Latitude × occupation	0.16			
	Demands × latitude	0.21**	.214	.011**	3,980
4	Demands × latitude × occupation	0.27*	.219	.005*	1,979
	Life satisfaction				
1	Control variables		.074		10,985
2	Job demands	0.02			
	Decision latitude	0.13**			
	Occupation	0.02	.081	.007	3,982
3	Demands × occupation	−0.13			
	Latitude × occupation	−0.17			
	Demands × latitude	0.17*	.089	.008*	3,979
4	Demands × latitude × occupation	0.27*	.094	.005*	1,978

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[a] The controls were (1) demographic variables (gender, age, job tenure, and education), (2) environmental factors (comparative income and adequacy of income), and (3) dummy variables for cities; occupation refers to the two occupational classifications, blue-collar workers ($n = 440$, coded 1), and white-collar workers ($n = 647$, coded 2).

* $p < .05$

** $p < .01$

*** $p < .001$

results obtained from blue-collar workers provided much less support for Karasek's model. For them, the relationship between job demands and anxiety was positive, regardless of the levels of control. The directions of the interaction for health problems were opposite to the prediction, with the most health problems occurring under high demands and high control. With regard to depression, job satisfaction, and life satisfaction, the interactive effects were in the hypothesized directions, but they were much less apparent than those detected in the data from white-collar workers. Evidently, Karasek's model applied better to white-collar workers than to blue-collar workers.

The main assumption underlying Hypothesis 6 was that the buffering effects of decision latitude would be greater for white-collar workers than for blue-collar workers. I investigated this assumption by testing the interactive effects of decision latitude and occupation. These variables had interactive effects on depression ($\Delta R^2 = .009$, $F_{1,1019} = 10.84$, $p < .001$), anxiety ($\Delta R^2 = .005$, $F_{1,1046} = 5.85$, $p < .05$), and job satisfaction ($\Delta R^2 = .005$, $F_{1,1046} = 6.49$, $p < .05$), but not on health problems and life satisfaction. Consistent with the assumption, decision latitude was negatively related to depression and anxiety and positively related to job satisfaction for white-collar workers. These effects were much less apparent for blue-collar workers.

To summarize the results from the tests of Hypotheses 2–6, 15 regression equations yielded 14 significant interactions, and all but 2 of these were in the hypothesized direction. Both inconsistent interactions occurred on psychosomatic health problems. The variance increments made by the observed two-way and three-way interactions were relatively small (ranging from .005 to .037 and averaging .014). Nevertheless, most of them meet the norm for a "genuine interaction" described by Evans (1985: 317).

DISCUSSION

The interaction of job demands and control has been a focus of research interest since the development of the job demands–control model. Researchers have made the most progress in the area of methodology by, for example, using multiple-source data to assess predictors and outcome variables (e.g., Dwyer & Ganster, 1991; Fox et al., 1993). In contrast, there has been relatively little theoretical development of the model. Thus, although the literature on organizational behavior has identified the pervasive impact of individual differences on the relationship between environmental stimuli and employee responses, researchers have continued to test the interaction posited by Karasek, rather than moving on to examine the relationship between this interaction and individual characteristics. My study represents a preliminary attempt to fill this gap.

The present study has contributed to the literature in two respects. First, it found support for Karasek's model from respondents in the People's Republic of China. I know of no previous study that has examined the applicability of Karasek's model to collective cultures. An important assumption underlying this research was that Karasek's model would generalize across cultures and, more specifically, that it would apply to China. The results are consistent with this premise. Because the interactive effects of job demands and control for the Chinese sample taken as a whole are very similar to those usually reported in the West, one can conclude that certain key variables and relationships contained within Western organizational theories are generally applicable across cultures.

Second, this study extended Karasek's model theoretically by exploring it in terms of individual differences. There has been an assumption in the literature that Karasek's major predictions—high-strain jobs lead to high stress and active jobs lead to high satisfaction—apply to everyone. The study reported here challenges this assumption by showing individual differences in the interaction between job demands and control. In my Chinese sample, active jobs did indeed satisfy individuals with perceived ability-job fit, but not those without fit. High-strain jobs provoked anxiety and depression in individuals with ability-job fit, but they were associated with decreased anxiety and depression among those with poor fit. In other words, what some individuals perceived as stimulating and challenging, others found excessively demanding and stressful. These findings support the theory of person-environment fit and stress (Caplan et al., 1975). They also lend support to Lazarus's (1991) notion that an individual's cognitive appraisal processes influence the effects of environmental events on his or her psychological health. Extended in this way, the job demands–control model can dynamically represent the way individuals process the interaction between themselves and their environment. Future researchers should consider taking individual differences into consideration in examining the interaction of demands and control.

This study demonstrated that Karasek's model applied better to white-collar respondents than to blue-collar respondents. The underlying reasons for the blue- and white-collar distinction appear to be complex. A number of individual and contextual characteristics, such as education, values, social status, and the level or type of control obtained at work, may jointly account for the difference. Further research is needed to explore the full range of variables that could have a bearing on job demands and control, as well as to determine whether the observed differences between blue-and white-collar workers are also found in other cultures. Among the factors discussed in this study, the difference in the types of control granted to blue- and white-collar workers appears to be a unique phenomenon in China. The differences between blue- and white-collar workers in education and social status, however, would seem to be applicable across cultures. Nonetheless, future research is needed to test the generalizability of the findings.

The exploration of individual differences has added to knowledge about the interaction between job demands and control. On the one hand, job demands and control are both external factors to job holders. How people cognitively interpret and appraise their external environment determines their levels of stress and satisfaction. On the other hand, although job demands and control are variables operating within organizations, they are influenced to a great extent by the larger environment within which organizations are embedded. Taking these factors together, researchers need to broaden their perspective on the interaction of demands and control.

Cross-cultural researchers have often relied on a variable called culture for developing hypotheses and interpreting results, and culture has commonly been conceptualized by dimensions such as individualism/collectivism and power distance (Hofstede, 1991). Although these dimensions have proven very useful, they are crude representations of culture, an extremely complex construct. My study leads me to believe that culture alone cannot effectively explain human attitudes and behavior. For one thing, Chinese traditional culture does not encourage individuals to value personal control. However, traditional values are not held equally by all members of a cultural community. Therefore, researchers must be careful to address the unique characteristics of the particular group and individuals under examination. Moreover, cultures are constantly in flux. Cultural values alter slowly under normal circumstances, but they seem to change much more rapidly during periods of drastic social upheaval such as that now occurring in China. Cultural dimensions such as individualism/collectivism and power distance fail to do justice to this dynamic aspect of culture and so should be used with caution.

The two interactions linked with psychosomatic health problems that were inconsistent with predictions (demands by control and demands by control by ability-job fit) also have implications for future research. In both cases, I can only speculate why the observed effects contradicted the hypotheses. One cause might be low reliability and accuracy of the self-reported data of psychosomatic health problems. Previous research has suggested that some Chinese men are hesitant in responding to questions about psychosomatic problems, because of a cultural norm that discourages complaints about personal sufferings (Xie, 1995). These results also point to the potential negative effects of possessing high control, if the combination of high demands and high control is indeed associated with increased health problems. This study was not designed to explicitly probe the psychometric properties of self-reported health problems, and the lack of data from alternative sources further constrained my ability to reach firm conclusions on this issue. However, this work did demonstrate the importance of addressing the issue in the future.

Implications for Management Practice

Although faced with remarkably different environments, Western and Chinese managers have, by virtue of their role requirements and social expectations, used worker control largely in such managerial techniques as democratic management, participative management, and management by objectives. There is a growing consensus among managers that workers will be more highly motivated if given more control over their working lives.

The results of this study underline the positive effects of high control, particularly with respect to white-collar workers and to individuals with perceived ability-job fit. However, the results reveal that high control may provoke stress in those who do not have the ability (or perceived ability) to handle it, and in those who do not desire personal control. The literature has also reported potential negative effects of possessing high control (e.g., Fox et al., 1993; Warr, 1987). Managers should note the potential for stress inherent in high personal control. Westerners who have to establish contact with, or manage, Chinese employees, should attend to intra-Chinese differences when implementing such managerial techniques as management by objectives.

Managers would also do well to draw practical implications from another set of results of this study, namely, the rather worrying fact that low control was associated with low anxiety and depression and high satisfaction among those without perceived ability-job fit. Research suggests that a low desire for control impairs an individual's confidence and leads to "deskilling" in the long run (Kohn & Schooler, 1982; Mortimer & Lorence, 1979). It also appears to increase the individual's reliance on external support for performing a job, whether that support is in the form of increased supervision and monitoring by managers or help from co-workers. Because these employee behaviors tend to diminish managerial effectiveness, managers should consider examining reasons for the lack of perceived ability-job fit and find ways to help their employees improve the fit.

Limitations and Directions for Future Research

Previous research on the demands-control model has been conducted either on multioccupational samples (e.g., Karasek, 1979) or on a single occupation (e.g., Fox et al., 1993). Each method has its advantages and drawbacks. According to Fox and colleagues, "A frequent criticism of the occupation-level research of Karasek and others in the epidemiological tradition is that there are large differences in socioeconomic status across occupations that vary significantly in demands and control. Because socioeconomic status factors are known to affect health and longevity, this confound poses a serious threat to findings in such work" (1993: 310). Testing the model on a single occupation may minimize the confounding effects of socioeconomic status, but it is unlikely to allow as much variance in job demands and control as exists in large, multioccupational studies.

The present study sought to address this problem: by covering a large range of occupations and jobs, I obtained sufficient variance in job demands and control. Collecting data from numerous organizations in different locations, however, led to other difficulties. In particular, there was not enough time to obtain all the objective data needed to provide a full context for the survey responses. The reliance on self-reports to assess the predictors and outcome variables inevitably raised concerns about common method variance. These concerns are reinforced by the fact that the field has started to move beyond self-report measures of employee well-being. Physiological and behavioral measures have recently been used to test Karasek's model (e.g., Dwyer & Ganster, 1991; Fox et al., 1993). Nevertheless, it is important to note that there is no theoretical reason to expect an *interaction* from common method variance. According to Evans (1985), correlated error cannot create spurious interactions, but it can attenuate true interactions. Similarly, Schmitt pointed out that "the presence of inflated correlations between independent and dependent variables and hypothesized moderator variables may reduce the power with which more complex relationships are investigated or our estimates of the relative sizes of different effects" (1994: 395).

Second, because this study was based on cross-sectional data, it cannot be used effectively as a basis for conclusions regarding causality. Job demands and control are chronic factors, and perceived ability-job fit is a dynamic process. Therefore, longitudinal research is needed to examine the joint effects of job demands, control, and ability-job fit on mental and physical outcomes for employees in both the short and long run.

Third, the general measure of job demands employed in this study made it impossible to distinguish between mental demands and physical demands. Recent research has suggested that mental demands have a greater effect on stress than physical demands (Dwyer & Ganster, 1991). Basing this study on a heterogeneous sample with regard to job design allowed me to use Karasek's (1979) measure of demands. Subsequent researchers, however, should consider examining the different demands experienced by people holding different kinds of jobs.

Finally, the fact that my data were collected from China raises legitimate questions regarding the applicability of these findings to the very different Western context. This caveat applies particularly to data that involved individual differences in the interaction of demands and control. However, this research did give considerable support to Karasek's model, and also to the model of person-environment fit and stress, leading to the inference that, despite their culturally distinct environments, there are indeed important similarities in people's behavior in organizations in China and the West.

To sum up, this research extended Karasek's model in two respects. It provided evidence for the model's applicability to China and also pointed to certain effects of individual differences on the interaction of job demands and control. Although these findings are preliminary, they do cast light on the cross-cultural applicability of Karasek's model as well as on its potential limitations. The reported results demonstrate the need to develop existing theories further and to test them cross-culturally if researchers are to develop a truly synergistic approach to management.

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RECRUITERS' AND APPLICANTS' REACTIONS TO CAMPUS INTERVIEWS AND EMPLOYMENT DECISIONS

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The relationship between college placement interviews and subsequent employment decisions by organizations and applicants has received scant research attention. In a longitudinal field study, we found that applicants' job choices were related to their postinterview intentions. However, organizations' job offer decisions were not related to recruiters' postinterview intentions or to their perceptions of applicants' intentions. The results offered general support for the applicability of the theory of reasoned action to the recruitment process.

Colleges are a key source of managerial and professional talent for organizations. Many of the new jobs that the U.S. economy will create by the year 2000 will require highly skilled, college-educated employees. Approximately half of all managers and professionals with less than three years of work experience are hired through college recruitment (Rynes & Boudreau, 1986). The college placement interview typically represents the first face-to-face encounter between graduating students and hiring organizations. Thus, organizations devote considerable time and expense to campus interviews. In fact, the employment interview is believed to be the most widely used selection tool for all types of employees (Hakel, 1982; Schneider & Schmitt, 1986). Given all the effort that organizations spend on campus interviews, one would hope that judgments based on these interviews are in some way related to later decisions about applicants. However, the link between campus interviews and subsequent decisions by organizations about applicants has received scant attention. Employers typically do not track the results obtained by their college recruiters (Rynes & Boudreau, 1986). Also, most research studies of selection interviews have regarded recruiters' postinterview evaluations of applicants rather than organizations' later decisions about those applicants as the outcomes of interest (cf. Breaugh, 1992; Dipboye, 1992).

Applicants also spend considerable time and energy on campus interviews. In Rynes, Bretz, and Gerhart's (1991) qualitative study of the job choices made by graduates of a major northeastern university, each student participated in an average 18 campus interviews. However, as Rynes (1991) observed, research has generally examined applicants' postinterview reactions to job opportunities rather than their actual job choice decisions:

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> To date, researchers have implicitly assumed that conclusions about job choice can be drawn on the basis of information about applicants' perceptions and intentions. However, perceptions and intentions are actually quite different from choices . . . . For example, stating one's perceptions or intentions is a completely "costless" exercise. In contrast, real job choices involve serious opportunity costs: Accepting one offer precludes accepting others (1991: 436).

Thus, little is known about the relationship between college placement interviews and the subsequent decisions made by either organizations or applicants. Subsequent decisions are different from perceptions of attractiveness expressed at the end of an interview. However, with few exceptions (e.g., Rynes et al., 1991), research has not linked campus interviews to their true final outcomes, which are the decisions that organizations and applicants make at various stages after the interviews about whether to proceed with negotiations about employment with the other party. The present study, which was designed to address this deficiency, used a longitudinal design to examine the relationship between college recruiters' and applicants' reactions to actual campus interviews with each other and (1) decisions by organizations regarding whether to (a) invite applicants for follow-up interviews and (b) offer them jobs and (2) decisions by applicants regarding whether to (a) accept invitations for follow-up interviews and (b) accept job offers.

THEORY AND HYPOTHESES

In particular, the study tests the applicability to the recruitment process of the theory of reasoned action (Ajzen, 1991; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), the dominant theoretical framework in the attitude-behavior literature (Olson & Zanna, 1993). According to the theory of reasoned action, there is a relationship between intentions to engage in behavior and the actual behavior that occurs later. Individuals are seen as making systematic and rational use of the information available to them before they decide whether to engage in a particular behavior. Assuming that the behavior is under an individual's control, theory advocates depict the intention to perform or not perform a behavior as the immediate and primary determinant of action. Intentions are depicted as capturing the motivational forces that influence whether a behavior occurs, including the attitude toward the behavior, perceived social norms, and the perceived ease or difficulty of performing the behavior. In summary, the theory of reasoned action regards human behavior as directly determined by individual's intentions, which are subject to social influences.

Research on the relationship between intentions and behavior has been conducted on a variety of behaviors, ranging from strategy choices in prisoner's dilemma games to decisions about having an abortion, smoking marijuana, and attending an employee training session. This research has generally found that, as the theory of reasoned action suggests, people tend to act in accordance with their intentions when they have control over their own behavior (cf. Eagly & Chaiken, 1993; Sheppard, Hartwick, & Warshaw, 1988). Applying the theory of reasoned action to the recruitment process, we might expect a relation between individuals' intentions to engage in the behavior of pursuing an employment relationship with another party and their actually engaging in the behavior.

The present study offers a test of the existence of a relationship between postinterview impressions and later decisions by both parties to the recruitment process, although it does not directly examine the cognitive or social processes that might explain such a relationship if it does exist. On the basis of the theory of reasoned action, we predicted that

> *Hypothesis 1: Recruiters' postinterview reactions to applicants are related to their organizations' decisions regarding whether to invite applicants for follow-up interviews.*
>
> *Hypothesis 2: Recruiters' postinterview reactions to applicants are related to their organizations' decisions regarding whether to offer jobs to applicants.*
>
> *Hypothesis 3: Applicants' postinterview reactions to job opportunities are related to their decisions regarding whether to accept invitations for follow-up interviews.*
>
> *Hypothesis 4: Applicants' postinterview reactions to job opportunities are related to their decisions regarding whether to accept job offers.*

However, intentions may change over time because people gain new information or events change their intentions. Ajzen and Fishbein (1980) proposed that the longer the interval between measurement of intentions and observation of behavior, the weaker the relationship between the intentions and the behavior. There is research evidence that temporal delay between the assessment of intention and observation of behavior limits the power of behavioral predictions (cf. Ajzen, 1985). For example, Steel and Ovalle (1984) found that intentions to leave were related to actual employee turnover but that the relationship grew weaker the longer the time between measurement of intentions and turnover.

After a campus interview, applicants and organizations who remain interested in each other gather further information about the other party. Organizations gain additional information on applicants from follow-up interviews as well as from other communications that may influence their job offer decisions. Applicants also gain new information on hiring organizations from follow-up interviews as well as other communications that may influence their job choice decisions. Rynes and colleagues (1991) found that delays in postinterview communications from organizations had strongly negative effects on applicants' job choice decisions. Thus, later decisions by organizations and applicants about whether to offer or accept jobs may be less related to postinterview reactions than earlier decisions about whether to offer or accept invitations for follow-up interviews.

In addition, the relationship between postinterview reactions and subsequent decisions may weaken over time if the person who participated in the campus interview is less involved with later decisions than with earlier decisions. Dipboye (1992) observed that the recruiter's role may not include decision making. In some situations, recruiters convey their impressions about applicants to others who then make decisions about whether to consider the applicants further. In other situations, recruiters only participate in the decision about whether to invite the applicant for a follow-up interview. Recruiters are unlikely to participate in final decisions about job offers unless they are also the hiring supervisors. Applicants are assumed to make their own decisions throughout the recruitment process.

Given the instability of intentions over time as new information is acquired (Ajzen, 1985; Ajzen & Fishbein, 1980), and, for organizations' decisions, the diminishing influence of recruiters over time (Dipboye, 1992), we predicted that

> *Hypothesis 5: Recruiters' postinterview reactions to applicants are more strongly related to organizations' decisions regarding whether to invite applicants for follow-up interviews than to organizations' decisions regarding whether to offer jobs to applicants.*
>
> *Hypothesis 6: Applicants' postinterview reactions to job opportunities are more strongly related to their decisions regarding whether to accept invitations for follow-up interviews than to their decisions regarding whether to accept job offers.*

Several models of the employment interview stress the influence of communications between recruiters and applicants during interviews (Dipboye, 1992; Jablin & McComb, 1984; Liden & Parsons, 1989; Street, 1986). For example, Dipboye's (1992) confirmatory model suggests that when recruiters interview applicants, they convey their impressions of the applicants by the way in which they conduct the interviews. Also, Liden and Parsons' (1989) model portrays recruiters and applicants as constantly processing verbal and nonverbal cues from each other during interviews. These models suggest that each party to an employment interview becomes aware of the other party's intentions by the end of the interview. An interesting implication of such models is that, as a result of gaining information about the other party's intentions, each party may be able to predict the other party's subsequent decisions.

The present study offers a test of the existence of a relation between perceptions of the other party's intentions and the other party's subsequent decisions. Drawing on models of an interview as an event during which an individual communicates his or her intentions to the other party (e.g., Dipboye, 1992; Liden & Parsons, 1989), we predicted that

Hypothesis 7: Recruiters' perceptions of applicants' intentions regarding job opportunities are related to applicants' decisions regarding whether to accept invitations for follow-up interviews.

Hypothesis 8: Recruiters' perceptions of applicants' intentions regarding job opportunities are related to applicants' decisions regarding whether to accept job offers.

Hypothesis 9: Applicants' perceptions of recruiters' intentions regarding themselves are related to organizations' decisions regarding whether to invite applicants for follow-up interviews.

Hypothesis 10: Applicants' perceptions of recruiters' intentions regarding themselves are related to organizations' decisions regarding whether to offer jobs to applicants.

METHODS

Sample and Procedure

The population of the study consisted of approximately 400 recruiters and 800 graduating college students who participated in approximately 3,200 employment interviews at the University of Connecticut during a full academic year. Recruiters could interview up to 12 applicants in a given day. Each recruiter was asked to complete a postinterview survey about 3 applicants whom he or she interviewed; the junior author randomly selected these 3 applicants. Upon their arrival at the campus placement facility, recruiters received a survey for each of these applicants with their interview schedules. They were asked to return completed surveys to a box in the interview area by the end of the day or to mail them to the senior author. Each of the 3 applicants rated by a given recruiter was also asked to complete a postinterview survey about the same interview. Applicants received a survey and stamped envelope by mail and were asked to return the completed survey using the stamped envelope by the end of one week after the interview. Cover letters for both surveys described the study as an investigation of the recruitment process and assured people of the confidentiality of responses. Before the end of the academic year, we attempted to contact each applicant who returned a survey by telephone to learn about subsequent decisions by both the organization and the applicant.

Of the recruiters, 266 returned surveys about applicants, a figure representing a response rate of 66 percent. Some recruiters completed surveys about only 1 or 2 applicants because applicants had failed to show up. In all, recruiters rated applicants in 729 interviews. Surveys were given to the applicants in 735 interviews, a figure representing 23 percent of all interviews conducted. Applicants returned 292 surveys, for a response rate of 40 percent. Matching surveys were returned by both the recruiter and the applicant in 219 interviews.

We reached 194 of the 219 applicants for whom matching surveys were available by telephone to inquire about decisions made after the campus interview by both the organization (whether to invite the applicant for a follow-up interview, whether to make a job offer) and the applicant (whether to accept an invitation for a follow-up interview, whether to accept a job offer). Five applicants did not hear again from the companies after the in-campus interviews; 4 applicants were told after the campus interviews that the job openings had been canceled; and 1 applicant informed the company that he had no further interest in the job opening after the campus interview but before he learned whether he would be invited for a follow-up interview. Because no data on subsequent decisions by either organization or applicant were available for these 10 applicants, we excluded them from analyses. In addition, 1 applicant did not hear again from the company after the follow-up interview; 2 applicants were told after the follow-up interviews that the job openings had been canceled; and 2 applicants informed the companies that they had no further interest in the job openings after the follow-up interviews but before they learned whether they would receive job offers. Because only partial data on subsequent decisions were available for these 5 applicants, they were also excluded from analyses. Therefore, data on subsequent decisions by either company or applicant were analyzed for 179 interviews.

Organizations made decisions about whether to offer follow-up interviews to all of these 179 applicants. Of these applicants, 78 (44%) were invited for follow-up interviews; 60 (77%) accepted the invitations. Thirty-one of these 60 (52%) were offered jobs, of whom 14 (45%) accepted the offers.

The average applicant in the 179 interviews for which matching surveys and complete data on subsequent decisions were available was 23 years old, had a grade point average of 2.98 (maximum = 4.00), had less than a year of work experience, and had had four previous interviews. Of the 179 applicants, 42 percent were women, 94 percent were completing bachelor's degrees, and 6 percent, master's degrees. Thirty-two percent majored in engineering fields, 54 percent in business fields, and 14 percent in other fields. Thirty-nine percent had returned surveys for previous interviews. The average recruiter in these interviews was 35 years old and had 5 years of recruiting experience. Twenty-nine percent were women, 27 percent were employed in the personnel function, and 73 percent in a function other than personnel.

The Applicant Survey

Evaluations. Each applicant was asked to rate the job for which he or she interviewed on 12 job attributes that were rated as highly important by graduating students in Posner (1981). Table 1 lists these attributes, which were rated on seven-point scales (1 = very weak, 7 = very strong). Applicants

TABLE 1
Evaluations of a Job Opportunity: Descriptive Statistics and Varimax-Rotated Factor Matrix[a]

			Factor	
Attribute	**Mean**	**s.d.**	**1**	**2**
Opportunity to learn	5.66	1.08	**.79**	.19
Opportunity to use my abilities	5.46	1.28	**.76**	.24
Variety of activities	5.12	1.28	**.76**	.09
Opportunity for rapid advancement	4.69	1.37	**.74**	.20
Challenging and interesting work	5.24	1.35	**.83**	.27
Competent and sociable co-workers	5.24	1.16	**.72**	.22
Opportunity to show effective performance	5.59	1.09	**.63**	.42
Job security	4.89	1.40	**.57**	.27
Location	5.11	1.53	−.06	**.79**
Salary	4.78	1.33	.49	**.60**
Reputation of company	5.40	1.35	.38	**.73**
Training programs	5.37	1.34	.46	**.60**
Overall evaluation of the job opportunity	4.96	1.70	**.59**	.47
Eigenvalue			6.67	1.16
Percentage of variance accounted for			51	9

[a] Bold entries represent the highest factor loading a variable had on either factor.

were also asked to provide an overall evaluation of the job opportunity via a variation on an item used by Harris and Fink (1987): "Overall, how attractive is this job to you?" (1 = very unattractive, 7 = very attractive).

Intentions. Applicants were asked, "Given how you feel now, what are the chances that you would accept a job offer if one was made to you by this company?" (0%, 10%, 20% . . . 80%, 90%, 100%). This item was used by Alderfer and McCord (1970).

Perceptions of the recruiter's intentions. Applicants were also asked two items that reflected the intentions items asked of recruiters (see below): "What do you think the chances are that you will be offered a follow-up interview?" (0%, 10%, etc.) and "How would you rate your chances for a job offer from this company?" (0%, 10%, etc.).

The Recruiter Survey

Evaluations. Recruiters were asked to rate applicants on eight characteristics that were rated as highly important by college recruiters in Posner (1981). These characteristics were rated on seven-point scales (1 = very weak, 7 = very strong): communications ability, future potential, personal appearance, personality, future ambitions, maturity, work experience, and knowledge about the company or job opening. Recruiters were also asked to evaluate the applicant's overall qualifications on a variation of an item used by Phillips and Dipboye (1989): "How would you evaluate this applicant's overall qualifications for the job?" (1 = very poorly qualified, 7 = very well qualified).

Intentions. Recruiters were asked, "Given how you feel now, what are the chances that this applicant will be offered a follow-up interview?" (0%, 10%, etc.) and "Given how you feel now, what are the chances that this applicant will receive a job offer from your company?" (0%, 10%, etc.). These statements were variations on two items Keenan (1977) developed.

Perceptions of the applicant's intentions. Recruiters were also asked one item about applicant's intentions: "How would you rate the chances that your job offer would be accepted if you were to make one to this applicant?" (0%, 10%, etc.).

Subsequent Outcomes

As in other field studies of the job choice process (e.g., Rynes et al., 1991), applicant reports of decisions by organizations about themselves as well as their own decisions were used. We called all applicants who returned surveys, beginning about a month after the campus interviews. We made as many calls as necessary to learn the final outcomes. Applicants were asked the following questions, with each decision coded 0 for no and 1 for yes: (1) "Were you invited for a follow-up interview?" (2) "If yes to 1: Did you accept the invitation for a follow-up interview?" (3) "If yes to 2: Did you receive a job offer?" and (4) "If yes to 3: (a) Did you accept the job offer? (b) At the time you made this decision: (i) How many job offers had you turned down? (ii) How many other job offers were you considering at the same time? and (iii) How many other job offers did you expect to get in the future?" The variable based on the sum of these three responses was called the number of other job offers.

Analysis

We performed logistic regression analyses to examine the relationship between postinterview reactions (i.e., evaluations and intentions regarding the other party) and each of the four dichotomous employment decisions under investigation. We calculated pseudo R^2 for each employment decision using the formula suggested by Aldrich and Nelson (1984).

To determine the unique contribution of each measure of postinterview reactions to each employment decision, we conducted a usefulness analysis (Darlington, 1968), calculating pseudo R^2 for the full model and then for a reduced model that did not contain the variable of interest. The difference in variance accounted for between the full and reduced models is the unique variance (usefulness) the removed variable accounts for (Pedhazur, 1982).

We also performed logistic regression analyses to examine whether perceptions of the other party's intentions were related to an applicant's and a recruiter's employment decisions.

Sampling Issues

Analyses were conducted on samples that were progressively smaller for each decision considered (n's = 179, 78, 60, and 31, respectively). Thus, the potential for sample bias was large. We explored the presence of sample bias in several ways. First, it was determined that recruiter and applicant data that were used in analyses did not differ significantly from recruiter and applicant data that were collected but not used because of lack of matching data from the other party or lack of complete information about the outcomes of subsequent decisions. Also, campus placement center officials who reviewed the data concluded that the demographic characteristics of the sample reflected the population of applicants and recruiters.

Further, within the data set for the 179 interviews included in analyses, we examined the effect of the sample's becoming progressively smaller on applicants' and recruiters' demographic characteristics, evaluations, intentions, and perceptions of the other party's intentions. Specifically, we compared data for interviews followed by an invitation for a follow-up interview ($n = 78$) to data for all other interviews ($n = 101$), compared data on interviews followed by acceptance of such an invitation ($n = 60$) to data on all other interviews ($n = 119$), and compared data on interviews followed by a job offer ($n = 31$) to that for all other interviews ($n = 148$).

Table 2 reports means for the demographic items for each sample. Recruiter age, gender, function, and years of recruiting experience, and applicant age, gender, grade point average, number of previous interviews, degree status, and completion of a survey for a previous interview (yes or no) did not significantly differ for any of these comparisons. However, Table 3 indicates that responses to almost all evaluation and intention items significantly differed for each comparison. For example, for all items except one, participants in campus interviews that were followed by a job offer ($n = 31$) responded more favorable to the other party (i.e., item means were higher) and more similarly to the other party (i.e., item standard deviations were

TABLE 2
Demographic Items by Sample[a]

Items[b]	$n = 179$	$n = 78$	$n = 60$	$n = 31$
Recruiter				
Age	35.1	35.0	35.5	34.8
Gender	1.29	1.32	1.27	1.16
Function	1.73	1.77	1.79	1.84
Years of recruiting experience	4.59	4.97	5.58	5.33
Applicant				
Age	22.6	22.5	22.7	23.4
Gender	1.42	1.40	1.37	1.42
Grade point average	2.98	2.98	3.00	3.04
Number of previous interviews	4.38	4.33	3.92	3.87
Degree status	1.06	1.05	1.05	1.10
Completion of survey for previous interview	1.61	1.53	1.55	1.71

[a] Values are means. Results of t-tests revealed no significant differences at the .05 level for the following comparisons: $n = 78$ vs. 101, $n = 60$ vs. 119, $n = 31$ vs. 148.

[b] Codes for the binary variables were as follows: gender, 1 = man, 2 = woman; function, 1 = personnel, 2 = other; degree status; 1 = bachelor's, 2 = graduate; and completion of survey for previous interview; 1 = yes, 2 = no.

TABLE 3
Evaluation and Intention Items by Sample

Variable	n = 179		n = 78		n = 60		n = 31	
	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.
Applicant survey								
1. The job itself[a,b,c]	5.20	0.96	5.45	0.88	5.60	0.75	5.69	0.70
2. Compensation and work environment[a,b,c]	5.18	1.07	5.36	1.01	5.56	0.85	5.58	0.80
3. Likelihood of job offer acceptance[b,c]	0.65	0.28	0.68	0.28	0.75	0.21	0.75	0.21
4. Likelihood of invitation for follow-up interview[a,b,c]	0.62	0.28	0.76	0.23	0.79	0.21	0.81	0.20
5. Likelihood of job offer[a,b,c]	0.54	0.28	0.66	0.24	0.70	0.21	0.76	0.19
Recruiter survey								
6. Applicant qualifications[a,b,c]	5.08	0.92	5.45	0.72	5.48	0.62	5.53	0.63
7. Likelihood of invitation for follow-up interview[a,b,c]	0.55	0.31	0.76	0.23	0.77	0.22	0.83	0.19
8. Likelihood of job offer[a,b,c]	0.42	0.28	0.60	0.22	0.60	0.22	0.65	0.17
9. Likelihood of job offer acceptance	0.62	0.22	0.65	0.18	0.65	0.16	0.67	0.15

[a] Significant difference at .05 level according to *t*-test: n = 78 vs.101.

[b] Significant difference at .05 level according to *t*-test: n = 60 vs.119.

[c] Significant difference at .05 level according to *t*-test: n = 31 vs.148.

lower) immediately after the interviews than participants in interviews that were not followed by a job offer ($n = 148$).

Thus, sample bias in the present study did not appear to be due to objective data associated with applicants or recruiters. Instead, when applicants progressed farther in the recruitment process, subjective reactions to the campus interview by both parties tended to be more uniformly positive.

RESULTS

Determination of Scales

Factor analysis was conducted on applicants' responses to the 12 job attribute items and the overall evaluation of the job opportunity item. A procedure of principal components analysis followed by varimax rotation of factors with eigenvalues greater than 1.0 was followed. Table 1 presents the varimax-rotated factor solution. The first factor, which accounted for 51 percent of the variance in ratings, was labeled "the job itself." The nine items that loaded highest on this factor included several job attributes, such as variety, challenge, and opportunities resulting from the job, as well as the overall evaluation item. The second factor, accounting for 9 percent of the variance in ratings, was labeled "compensation and work environment." The four items that loaded highest on this factor pertained to salary, reputation, location, and training programs. Scales' scores were then calculated as the average of the items loading highest on each factor. Coefficient alpha was .90 for the job itself and .75 for compensation and work environment.

Factor analysis was also conducted on recruiters' responses to the eight applicant characteristic items and the overall evaluation of the applicant qualifications item. Principal components analysis yielded one factor with an eigenvalue greater than 1.0. This factor, with an eigenvalue of 5.58, explained 62 percent of the variance in ratings. Factor loadings for the nine items on this factor ranged from .64 to .87. Coefficient alpha for the scale calculated from these items was .92.

Relationship between Postinterview Reactions and Employment Decisions

Table 4 reports descriptive statistics and correlations for survey responses, including the above scales, and subsequent outcomes.

Table 5 presents the results of a logistic regression analysis for the organizations' decisions as to whether to invite applicants for follow-up interviews. In support of Hypothesis 1, recruiters' postinterview reactions to applicants were significantly related to organizations' decisions about invitations for follow-up interviews, combining to explain 30 percent of the variance ($p < .001$). One of the two measures of recruiters' intentions, the likelihood that the applicant would be invited for a follow-up interview, was the only predictor to explain a significant amount of unique variance.

Table 5 also presents the results of a logistic regression analysis for the organizational decision on offering jobs to applicants. Recruiters' postinterview reactions to applicants were not significantly related to organizations'

TABLE 4
Descriptive Statistics and Correlations[a]

Variable	Mean	s.d.	1	2	3	4	5	6	7	8	9	10	11	12	13
Applicant survey															
1. The job itself	5.20	0.96													
2. Compensation and work environment	5.18	1.07	.73												
3. Likelihood of job offer acceptance	0.65	0.28	.65	.58											
4. Likelihood of invitation for follow-up interview	0.62	0.28	.36	.19	.34										
5. Likelihood of job offer	0.54	0.28	.36	.24	.34	.92									
Recruiter survey															
6. Applicant qualifications	5.08	0.92	.15	.07	.03	.27	.23								
7. Likelihood of invitation for follow-up interview	0.55	0.31	.23	.09	.12	.50	.44	.65							
8. Likelihood of job offer	0.42	0.28	.15	.01	.05	.40	.37	.69	.91						
9. Likelihood of job offer acceptance	0.62	0.22	.07	.07	.07	.16	.15	.31	.34	.38					
Subsequent outcomes															
10. Invitation for follow-up interview	0.44	0.50	.23	.15	.11	.44	.39	.35	.60	.53	.11				
11. Acceptance of invitation for follow-up interview	0.77	0.42	.32	.36	.45	.25	.31	.06	.08	.04	−.03				
12. Job offer	0.52	0.50	.11	.02	.00	.09	.27	.08	.29	.24	.13				
13. Acceptance of job offer	0.45	0.51	.19	.10	.56	.04	−.08	.17	.05	.14	.53				
14. Number of other job offers	2.69	2.09	.16	.20	−.13	.36	.41	.12	.24	.16	−.15				−.56

[a] Except for correlations with the following variables, $n = 179$; for variable 11, $n = 78$; for variable 12, $n = 60$; and for variables 13 and 14, $n = 31$.

TABLE 5
Decisions by Organizations

Variable	Invitation for Follow-Up Interview b	Invitation for Follow-Up Interview s.e.	Invitation for Follow-Up Interview Unique Pseudo R^2	Job Offer b	Job Offer s.e.	Job Offer Unique Pseudo R^2
Application qualifications	0.05	0.34	.00	−0.10	0.53	.00
Likelihood of invitation for follow-up interview	0.05**	0.02	.05***	0.02	0.02	.02
Likelihood of job offer	0.01	0.02	.00	0.01	0.02	.00
Constant	−3.74*	1.51		−1.65	2.53	
Chi-square	71.28***			4.56		
df	3			3		
Pseudo R^2	.30			.08		
n	179			60		

* $p > .05$
** $p > .01$
*** $p > .001$

job offer decisions, explaining only 8 percent of variance. Thus, Hypothesis 2 was not supported.

Table 6 reports the results of a logistic regression analysis for the applicants' decisions about accepting invitations for follow-up interviews. In support of Hypothesis 3, applicants' postinterview reactions to job opportunities were significantly related to their decisions about invitations for follow-up interviews, combining to explain 18 percent of the variance ($p < .001$). The measure of applicants' intentions, the likelihood of job offer acceptance, was the only predictor to explain a significant amount of unique variance.

Table 6 also reports the results of a logistic regression analysis for the applicants' decision on accepting job offers. In support of Hypothesis 4, applicants' postinterview reactions to job opportunities were significantly related to their decisions about job offers, combining to explain 29 percent of variance ($p < .01$). The measure of applicants' intentions, the likelihood of job offer acceptance, was the only predictor once again to explain a significant amount of unique variance.

We performed an additional logistic regression analysis to determine whether controlling for the number of other job offers (including offers that an applicant had turned down, was considering at the same time, or expected to receive in the future) would influence whether applicants' intentions predicted their decisions about job offers. The likelihood of job offer acceptance and the number of other job offers were the only independent variables included in this analysis (results not shown). These two variables combined to explain 43 percent of the variance in applicants' decisions about job offers ($p < .001$), with the likelihood of job offer acceptance explaining 24 percent of unique variance after the number of other job offers

TABLE 6
Decisions by Applicants

Variable	Acceptance of Invitation for Follow-Up Interview Decision			Acceptance of Job Offer Decision		
	b	s.e.	Unique Pseudo R^2	*b*	s.e.	Unique Pseudo R^2
The job itself	−0.20	0.55	.00	−0.51	1.19	.00
Compensation and work environment	0.61	0.47	.02	0.12	0.85	.00
Likelihood of job offer acceptance	0.03*	0.01	.07*	0.10*	0.05	.26***
Constant	−2.82	2.01		−5.78	4.39	
Chi-square	16.66***			12.27**		
df	3			3		
Pseudo R^2	.18			.29		
n	78			31		

* $p < .05$
** $p < .01$
*** $p < .001$

was controlled ($p < .001$). In further support of Hypothesis 4, an applicant was still more likely to accept a job when the likelihood of job offer acceptance was high. The applicant was also more likely to accept the job when the number of other job offers was low ($p < .05$).

The results presented in Table 5 suggest that recruiters' postinterview reactions to applicants were more strongly related to organizations' decisions about whether to invite applicants for follow-up interviews ($R^2 = .30$) than to decisions about whether to offer jobs to applicants ($R^2 = .08$). Thus, Hypothesis 5 appeared to be supported. However, contrary to Hypothesis 6, the results presented in Table 6 show that applicants' postinterview reactions to job opportunities were not more strongly related to their decisions about invitations for follow-up interviews ($R^2 = .18$) than to their decisions about job offers ($R^2 = .29$). Instead, the opposite was true.

Predictions of the Other Party's Employment Decisions

Contrary to Hypothesis 7, recruiters' perceptions of applicants' intentions were not significantly related to applicants' decisions regarding whether to accept invitations for follow-up interviews ($R^2 = .00$, n.s., $n = 78$). However, in support of Hypothesis 8, recruiters' perceptions of applicants' intentions were significantly related to applicants' decisions regarding whether to accept job offers ($R^2 = .25$, $p < .01$, $n = 31$). Hypotheses 9 and 10, pertaining to applicants' ability to predict organizations' decisions about themselves, were also supported. Applicants' perceptions of recruiters' intentions were significantly related to organizations' decisions regarding whether to invite them for follow-up interviews ($R^2 = .18$, $p < .001$, $n = 179$) and whether to offer them jobs ($R^2 = .07$, $p < .05$, $n = 60$).

DISCUSSION

A longitudinal study supported the existence of a relationship between applicant and interviewer postinterview reactions to the other party in college placement interviews and subsequent employment decisions. Applicants' postinterview intentions to accept job offers were related to their later decisions about whether to accept invitations for follow-up interviews and whether to accept actual job offers. Regardless of how many other job offers an applicant had turned down in the past, was considering at the same time, or expected to receive in the future, the stronger the postinterview intention to accept a job offer, the more likely he or she was to accept a job that was actually offered. In addition, recruiters' postinterview intentions to invite applicants for follow-up interviews were related to organizations' decisions about whether to extend such invitations. However, recruiters' postinterview evaluations and intentions regarding applicants were not related to organizations' decisions about whether to offer jobs to them.

Results offered general support for the applicability to the recruitment process of the theory of reasoned action (Ajzen, 1991; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), which has successfully explained behavior in other contexts (Eagly & Chaiken, 1993; Sheppard et al., 1988). Postinterview intentions were related to outcomes of three of the four employment decisions examined; the only decision that was not related to intentions was the job offer decision by organizations. The results also supported models of the employment interview as a setting in which recruiters and applicants exchange useful information (e.g., Dipboye, 1992; Liden & Parsons, 1989), as each party's perceptions of the other's intentions were related to one or both of the other's later decisions. However, applicants appeared to learn more from the exchange, since they were able to predict both decisions about themselves by organizations, whereas recruiters were only able to predict applicants' job offer acceptance decisions. The fact that both recruiters and applicants thought that it was more likely that the applicants would accept job offers than that the organizations would make them (Table 4) suggests that applicants had a greater need to sell themselves to recruiters than vice versa. Thus, as others have suggested (e.g., Harris, 1989), applicants may have been particularly motivated to pay close attention to messages received during interviews; they may have also felt a greater need to make use of impression management tactics to appear to be interested in the jobs and thereby positively influence recruiters' judgments (Gilmore & Ferris, 1989; Stevens & Kristof, 1995).

The argument that the relationship between intentions and behavior weakens over time (Ajzen, 1985; Ajzen & Fishbein, 1980), which has been supported by research on other behavioral phenomena, such as turnover (Steel & Ovalle, 1984), received mixed support, appearing to explain decisions made by organizations but not those made by applicants. For organizations, this effect may have occurred because some of the individuals who stated the intentions (that is, the campus recruiters) were uninvolved in the final job offer decisions (Dipboye, 1992). In addition, organizations may have had smaller targeted selection ratios for job offers than for invitations for follow-up interviews, reducing the size of the relationship for later decisions.

However, applicants' postinterview intentions had a greater effect on their later decisions about job offers than on their earlier decisions about follow-up interviews. This finding may have occurred for several reasons. As Rynes (1991) suggested, going on a follow-up interview may be essentially a costless exercise except for the time lost. In contrast, the decision to accept a job offer necessarily precludes an applicant's taking advantage of other job opportunities. Also, applicants may have been risk-averse about the possibility of their receiving no job offers. As a result, they may have accepted invitations for follow-up interviews from organizations that were not their top choices to generate potential fallbacks. Further, they may have felt that it was important to be able to reject at least one job offer in order to feel better about their top choices. Soelberg (1967) and Glueck (1974) found that even when applicants had offers from their top choices in hand, they attempted to generate at least one more job offer for comparison purposes but evaluated that alternative in a biased manner so that their initial choices were confirmed. Thus, postinterview intentions may have been taken into account more in applicants' decisions about job offers because these decisions had greater consequences than decisions about second interviews and better reflected their true feelings about job opportunities. On the other hand, this difference may have been inherent in the intention measured, namely, the intention to accept a job offer. This intention may have been a better predictor of the later decision (whether to accept a job offer) than of the earlier decision (whether to accept an invitation for a follow-up interview) because it was better matched with the later decision.

The results do not necessarily imply that postinterview intentions were formulated in response to interactions in the campus interviews. It is quite possible that applicants already intended to take the jobs interviewed for if they received offers. Applicants' postinterview reactions were unlikely to be based solely on what they learned in the interviews. By the time they enter interviews, applicants are likely to have formed some impressions about the jobs in question. Powell (1991) found that applicants' preinterview intentions were related to their postinterview intentions. In our study, applicants' postinterview intentions were related to their decisions regarding whether to accept job offers. These findings collectively suggest that applicants may form early impressions about jobs that are largely sustained as they proceed through campus interviews and make their eventual job choices. If this is the case, perhaps organizations do not need to undertake campus interviews to attract applicants and could obtain the same results, job acceptances, through less costly means. However, if they abandoned employment interviews, they would risk offending applicants who rely on them as an opportunity to "put your best foot forward" (Hakel, 1982).

In the same vein, recruiters may have intended to offer some applicants follow-up interviews before the campus interviews even took place. Phillips and Dipboye (1989) and Macan and Dipboye (1990) found that recruiters' preinterview impressions of applicants were related to their postinterview intentions. In this study, recruiters' postinterview intentions were related to decisions about whether to invite applicants for follow-up interviews but not to decisions about whether to offer applicants jobs. If organizations only use the campus interview as an initial screening device, as these results suggest, it would seem that they could base decisions about which applicants to invite for site visits on information such as paper credentials without assuming the expense of campus interviews.

Thus, although this study suggests that reactions to campus interviews are related to later decisions by both parties to the recruitment process, further research is desirable to determine the exact role that the campus interview plays in this process. For example, research should examine whether applicants' reactions to campus interviews mediate the relationship between their early impressions of job opportunities and their later decisions about the same opportunities. Ideally, such research would compare data from applicants who experience campus interviews with data from a control group of applicants who do not experience campus interviews. It would enable a collective test of the relationships between applicants' preinterview impressions, postinterview reactions, and subsequent decisions that have been examined to date in a piecemeal fashion in Powell (1991) and this study; it would also go beyond other longitudinal studies of applicants' job choices (e.g., Glueck, 1974; Rynes et al., 1991; Soelberg, 1967) that did not include data on preinterview impressions of job opportunities with specific companies. Similarly, research should examine whether recruiters' reactions to campus interviews mediate the relationship between their initial impressions of applicants based on review of paper credentials and their organizations' decisions about the same applicants. Such research would compare data on judgments and decisions about applicants who experience campus interviews with data on applicants who do not experience campus interviews. It would extend prior research on self-fulfilling prophecies in the selection process (e.g., Dougherty, Turban, & Callender, 1994; Macan & Dipboye, 1990; Phillips & Dipboye, 1989) to include data on organizations' subsequent decisions about applicants as outcomes. However, it should be acknowledged that it would be difficult to persuade organizations and applicants to forsake employment interviews for the purpose of conducting such research.

Since applicants' early impressions appear to be related to their later decisions about job opportunities, whether directly or indirectly through campus interviews, we also recommend further research on how these impressions are formed and how they influence applicants' preinterview decisions about job opportunities. For example, studies should examine how these impressions affect applicants' bidding for campus interviews, which represents their first narrowing-down decision regarding the multitude of job opportunities about which they have gathered information and formed impressions. Finally, more studies are needed that examine applicants' reactions to the full array of employment options that they pursue (e.g., Glueck, 1974; Soelberg, 1967; Rynes et al., 1991) as well as studies such as the present one that focus on applicants' reactions to single job opportunities.

Even if campus interviews are shown to have little direct influence on subsequent decisions, it is unlikely that organizations will ever abandon them completely. The results of this study also suggest that, if campus interviews are to be held, organizations could make better use of the information gathered in them. Recruiters' perceptions of applicants' intentions explain one-quarter of the variance in applicants' actual decisions about job offers. In fact, recruiters were able to predict with greater accuracy whether applicants would accept job offers than whether their own organizations would make job offers. However, employers did not take recruiters' perceptions of applicants' intentions into account in deciding whether to make job offers; post hoc analysis revealed that no additional variance in organizations' job offer decisions was explained by adding recruiters' perceptions of applicants' intentions as a predictor to the logistic regression equation in Table 3 ($\Delta R^2 = .00$, n.s.). Pursuing applicants who are disinclined to accept job offers, even if they are the best applicants, is a risky selection strategy that could cost organizations the chance to hire applicants who are marginally less qualified but more inclined to accept offers. These results suggest that employers might enhance the utility of each campus interview (Dipboye, 1992; Murphy, 1986) by taking into account the recruiter's perceptions of the applicant's intentions when deciding whether to offer that applicant the job.

LIMITATIONS AND CONCLUSIONS

As in most field studies, all of the factors that might have explained the outcomes examined could not be measured. Variables that were not measured might have explained decisions better than the measured variables. For example, Rynes and colleagues (1991) found that the nature of communications after campus interviews, including recruitment delays, influenced whether applicants accepted invitations for site visits and job offers. Also, organizations' use of realistic job previews versus more traditional approaches to presenting themselves in interviews may have influenced applicants' decisions (Wanous & Colella, 1989). We recommend further longitudinal research that includes as independent variables the amount and quality of information that is communicated and the timing of postinterview communications, as well as postinterview reactions to the other party, to provide a more comprehensive view of the factors that explain employment decisions.

Common method variance, or halo, may have contributed to the high within-survey correlations in Table 4. The use of a longitudinal design that linked responses to surveys completed by two different parties to decisions reported afterwards reduced the possibility of the results being distorted by assessment of all variables at the same time. However, it did not eliminate the possibility entirely. Also, because multiple responses were present from both recruiters and applicants, recruiters might have responded similarly to applicants across interviews, and vice versa. However, each interview represented a unique interaction between a recruiter and an applicant.

The frequencies (*n*'s) for the different employment decisions declined as we considered the outcomes of decisions in successive stages of the recruitment process. This was an inevitable result of our research strategy of tracking the outcomes of particular campus interviews; only the survivors of a given stage were included in the sample for the next stage. As noted earlier, the samples associated with different decisions did not differ on objective data for applicants or recruiters. Instead, as the sample size became smaller, survey responses were more positive and more restricted in range. However, this kind of difference between samples can be construed as validating the link between postinterview reactions and employment decisions that the study suggests. It is to be expected that applicants and organizations that are still talking to each other at the last stage of the recruitment process will have more positive impressions of each other than applicants and organizations that terminated their discussions earlier. Thus, the difference in such impressions between samples seemed realistic and appropriate.

The shrinking sample size for successive decisions may have also influenced the results of tests of the various relationships examined. However, this did not appear to cause a problem. For example, according to recommendations in Cohen (1992: 158), an n of 30 was needed here to detect a large effect size in multiple regression analysis (i.e., $R^2 = .26$) with two independent variables at a significance level of .05 and power of .80. Although the regression equation for applicants' job offer acceptance decisions in Table 6 contains three independent variables, the value of R^2 was .29 when either compensation and work environment or the job itself was removed from the equation as an independent variable; as a result, the n of 31 for this decision was sufficient to detect the large effect that actually was found. By the same standard, the n of 179 for organizations' decisions about whether to invite applicants for follow-up interviews was more than sufficient to detect the large effect that was found ($R^2 = .30$). Further, since an n of 76 was needed to detect a medium effect (i.e., $R^2 = .13$) of three independent variables at the same significance level and power (Cohen, 1992), the n of 78 for applicants' decisions about whether to accept invitations for follow-up interviews was sufficient to detect the effect that was found ($R^2 = .18$). In contrast, since the effect size for organizations' job offer decisions ($R^2 = .08$) was smaller than Cohen's (1992) estimate of a medium effect, the n of 60 was insufficient to conclude that such an effect existed. Thus, despite differences in sample sizes, the results of tests of significance tended to properly reflect differences in effect sizes.

Further, the results may have been influenced by the study's focus on campus interviews rather than interviews conducted in other settings. Few applicants in this study had any full-time work experience. Applicants with more experience may have a greater awareness of the jobs for which they are applying, rendering initial employment interviews a different experience for them than for graduating college students. We recommend replication of this study in off-campus settings with other types of applicants. Finally, since the number of interviews analyzed represented only a small proportion of the total number of campus interviews conducted in the given academic year, all results should be interpreted with caution.

In conclusion, in this longitudinal field study we found that postinterview intentions were related to organizations' decisions about whether to invite applicants for follow-up interviews and to applicants' decisions about whether to accept such invitations and job offers. The study supports the applicability of the theory of reasoned action (Ajzen, 1991; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) to the recruitment process. However, when considered in conjunction with the results of other research suggesting a relationship between the preinterview impressions of applicants (Powell, 1991) and recruiters (Macan & Dipboye, 1990; Phillips & Dipboye, 1989) and their postinterview intentions, these results raise the possibility that the campus interview may play only a minor role in the formation of intentions and subsequent decision making by organizations and applicants. Further longitudinal research is needed to determine the incremental contribution of campus interviews or organizations' college recruitment and applications' job choice strategies.

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RESEARCH NOTES

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GUANXI: CONNECTIONS AS SUBSTITUTES FOR FORMAL INSTITUTIONAL SUPPORT

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Interview data from China are used to test an argument that executives develop personal connections in societies with underdeveloped legal support for private businesses. In China, such connections are called *guanxi.* An underdeveloped legal framework makes private-company executives more dependent on *guanxi* than executives in state-owned or collective-hybrid companies. Compared to the other executives, private-company executives considered business connections more important, depended more on connections for protection, had more government connections, gave more unreciprocated gifts, and trusted their connections more.

Although executives spend substantial time interacting with others outside their organizations, theories of organizational behavior are surprisingly silent on the meaning of these contacts. Sociologists and organizational theorists have studied structural connections among executives for years (Granovetter, 1985; Larson, 1992; Macaulay, 1963; Powell, 1990; Yan & Gray, 1992). However, formal structure provides an incomplete picture of how executives develop connections. Executives also meet with others in settings of their own choosing and strive to build personal dependence in addition to formal structural dependence. As others have noted, informal relations help employees work around formal constraints within organizations (e.g., Crozier, 1964; Pfeffer, 1992). We propose that one reason executives seek out connections and cultivate close personal relationships is to obtain resources or protection not otherwise available.

Such personal connections seem particularly important to executives in countries without a stable legal and regulatory environment that allows for impersonal business dealings (Redding, 1990; Zucker, 1986). For example, without an impartial judiciary, executives are reluctant to develop business relationships with those they do not personally trust. The importance of

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good personal relationships to doing business in developing countries has been discussed widely in popular writings for managers (cf. *Asian Advertising and Marketing,* 1989; Fox, 1987), yet the advice given in business periodicals has rarely been analyzed in management scholarship. We drew on the work of Redding (1990), Putnam (1993), and Nee (1992, 1989) to develop hypotheses about which executives in the People's Republic of China will find personal relationships more important for business and invest more in their cultivation.

In China, interpersonal connections are called *guanxi.* In her comprehensive study, Yang stated that *guanxi*

> means literally "a relationship" between objects, forces, or persons. When it is used to refer to relationships between people, not only can it be applied to husband-wife, kinship and friendship relations, it can also have the sense of "social connections," dyadic relationships that are based implicitly (rather than explicitly) on mutual interest and benefit. Once guanxi is established between two people, each can ask a favor of the other with the expectation that the debt incurred will be repaid sometime in the future (1994: 1–2).

In China, *guanxi* usually does not carry negative connotations, whereas allowing something to be decided by open competition instead of by using connections may be considered stupid and disloyal (e.g., Alston, 1989; Chen & Pan, 1993; Hwang, 1987; Lockett, 1988; Yau, 1988). Despite its importance, we know of no empirical tests of *guanxi* or of the circumstances that shape when, where, and with whom such relationships should be most important to managers.

FRAMEWORK AND HYPOTHESES

Guanxi as a Substitute for Formal Institutional Support

We suggest that managers cultivate personal connections to substitute for reliable government and an established rule of law, characteristics we merge under the label "structural support." This idea is hardly new (cf. Boisot, 1986; Coleman, 1993; Fallers, 1965; Putnam, 1993; Riggs, 1964; Walder, 1986), but it has not been systematically tested. Redding observed that networks in China are useful in "the regulation of transactions in the absence of state institutions for that purpose" (1990: 56). Certainly, many observers have noted that *guanxi* is endemic in Chinese business (Alston, 1989; Hall & Xu, 1990; Jacobs, 1980; Leung & Yeung, 1995; Lockett, 1988; Yang, 1994; Yau, 1988), yet Walder noted that "the concept is by no means culturally unique [to China]; the terms *blat* in Russia and *pratik* in Haiti refer to the same type of instrumental-personal tie. *Guanxi* is not a sociologically precise term: it refers to instrumental-personal ties that range from strong personal loyalties to ceremonial bribery" (1986: 179). A weak rule of law is problematic for all who do business in China, but such unreliability would prove particularly burdensome for newer, smaller private businesses. China today provides a context in which we can study the role of connections as manager-initiated substitutes for the kind of formal institutional support taken for granted in countries with more stable business environments.

Nee (1992) classified Chinese organizations into three types: state (federal)-owned, privately owned, and collective-hybrids, enterprises typically owned by local governments that produce products for competitive markets. He noted that China's transitional economy is characterized by weak capital market structures, poorly specified property rights, and institutional instability, of which a lack of coherent business laws is an example. These characteristics make market exchanges uncertain and costly. Under these circumstances, private companies have difficulty getting capital, because the banks, which are state-owned, favor state-owned companies. Further, in a country with uncertain property rights, the potential for threatening interference and expropriation from party and governmental officials is great. According to Nee, collective-hybrids have structural advantages over both privately owned and state-owned companies, because being affiliated with local governments protects them from government interference. At the same time, collective-hybrids sell in competitive markets, so they face "hard budget constraints" (Kornai, 1989) that encourage efficiency, unlike state-run companies. As Nee noted, Chinese state-owned companies, which face substantial regulatory restraint on wages, prices, capital expenditures, and product mix, are at a substantial organizational disadvantage. Similarly, Chinese private companies, which do not have the institutional protection of government ownership that state-owned and collective-hybrid companies do, are subject to arbitrary extortion by officials and others since the society lacks a reliable rule of law.

We take Nee's insights as a point of departure and suggest that Chinese private-company executives operating without the structural protection of governmental support, which is more available to state-owned and collective-hybrid organizations, will not passively await their fate. Rather, by developing *guanxi* as a substitute for the formal institutional protection government ownership offers their counterparts, they will cultivate close personal relationships with people useful to business. Certainly, all Chinese managers will use *guanxi*, but these connections will be seen as even more important by those with less structural support—that is, by private-sector managers.

Controlling for the Liability of Newness and Smallness

Before proceeding, it is necessary to discuss a potential alternative explanation for the greater importance of personal connections to executives in Chinese private companies. Private companies are relatively new and small in a country that is still, at least nominally, communist. Their executives may cultivate connections to counteract liabilities of newness and smallness, not as a substitute for structural protection.

Stinchcombe (1965) claimed that new organizations generally face greater risks than older organizations, because they lack external legitimacy. Empirical studies have tended to support the idea that newness is a liability for organizations (e.g., Delacroix & Carroll, 1983; Freeman, Carroll, & Hannan, 1983; Hannan & Freeman, 1989; Singh, Tucker, & House, 1986). Further, Freeman and colleagues (1983) showed that smallness presents its own liabilities to organizational survival. Aldrich and Auster (1986) suggested this is because new, small organizations have executives with fewer ties with others. Further, Singh and colleagues (1986) and Aldrich and Fiol (1992) found that as the number of ties held by executives of new and small organizations increased, the chances of their survival increased. Thus, in China, it is possible that executives in private companies stress the importance of their personal connections simply to counteract liabilities that result from their organizations' youth and smallness, not as a substitute for formal structural support via ownership. Therefore, to conduct a stronger test of the structure-substitution hypothesis, we needed to control for organizational age and size.

> *Hypothesis 1: With the age and size of their companies controlled, executives in private Chinese companies will report that their business connections are more important to their success than will executives in either state-owned or collective-hybrid companies.*

Using *Guanxi*

If *guanxi* is more important to managers with great need for a substitute for formal structural support, this importance should be reflected in the ways these managers characterize their relationships. In particular, we would expect such a substitution to be reflected in greater reliance on connections as a defense against threats, a greater reliance on connections in government, and reports of deeper and closer connections on the part of private executives. Those who rely on their business connections as a substitute for a stable rule of law would also be expected to see them as primarily defensive. That is, rather than reporting the usefulness of connections in obtaining customers, market information, or securing credit, as managers in stable developed-market economics might, managers in less developed countries may report needing connections to help them face fundamental threats, such as expropriation and extortion (Nee, 1992; Redding, 1990; Yang, 1994).

> *Hypothesis 2: Executives in private Chinese companies are more likely to report that their business connections are useful as a defense against threats than are executives in either state-owned or collective-hybrid companies.*

Further, threats to companies in such societies can come from a misuse of ill-defined power or the absence of governmental protection from extortionists and thieves. In addition, private companies need access to resources controlled by government. Thus, we would expect good connections in government to be of paramount importance to those in societies with a weak rule of law. In China, executives of state-owned and collective-hybrid companies secure their government protection structurally, via government ownership. To substitute for such protection, private-company managers will use personal connections to government officials.

> *Hypothesis 3: Compared to executives in either state-owned or collective-hybrid Chinese companies, executives in private Chinese companies will report more connections with individuals who hold positions in government.*

Finally, we propose that private-company executives will seek to build relationships that are deeper in trust (closer *guanxi*) than those sought by executives with structural protection. Sociologists long have argued that "modern" forms of impersonal bureaucratic organization provide substitutes for the particularistic trust relationships characteristic of premodern societies (Coleman, 1993; Riggs, 1984; Walder, 1986; Weber, 1947; Zucker, 1986). Clear property rights, an independent judiciary, and predictable impersonal enforcement of regulations provide institutional protection that does not depend on the particularistic knowledge of others. People need only assume that others are following the known rules (Coleman, 1993; Weber, 1947; Zucker, 1986). However, without this form of structural protection, business executives must fall back on particularistic relations (Redding, 1990; Zucker, 1986). Because the kind of protection required may involve risks for both parties, risks such as bending or ignoring laws, managers would seek to develop business relationships that are as trustworthy as possible. This depth of relationship should be reflected in reports of greater trust in connections among those who most depend on them for protection.

> *Hypothesis 4: Executives in private Chinese companies will report that their business connections are characterized by more trust than executives in either state-owned or collective-hybrid companies will report as characteristic of their relationships.*

Building *Guanxi*

How can executives build good connections with people who can provide resources and protection? Although many ways of doing this may be possible, in China normative expectations are clear, as they are built on long traditions of *guanxi* (Redding, 1990; Yang, 1994). How is *guanxi* developed in China? Jacobs (1980) suggested that *guanxi* depends primarily on shared identification with family, hometown, region, school, or place of work. The possibilities are varied enough that people motivated to build *guanxi* can find a common basis. This is not to suggest that common background will necessarily lead to good *guanxi* between people. It does imply that individuals who do not share some of these common backgrounds will have less of basis for developing *guanxi* than individuals who do. However, *guanxi* varies in its closeness, and Jacobs argued that it can be made closer either by a social interaction that contributes to positive affect (*ganqing*) or by helping, both of which rely, to some extent, on gift giving as an indication of goodwill and respect:

> If, for example, a township leader wishes to make his *guanxi* with a village leader closer, the township leader will attempt to increase the social interaction between them by inviting the village leader to banquets on such occasions as weddings in the township leader's family and festivals in his home village. Should a wedding occur in the village leader's family, the township leader will be sure to send a wedding gift (1980: 228).

In building *guanxi,* gift giving continues over time. As Alston noted "*Guanxi* ties have to be continuously reinforced" (1989: 28). Two of the most frequently used tactics to enhance *guanxi* in Chinese society are presenting a gift to and holding a banquet for the other party (Hwang, 1987).

Although *guanxi* often involves the exchange of gifts, these gifts are viewed as investments in the relationship. The emphasis in China is on the relationship being built (Hwang, 1987; Yang, 1994). They are not fee-for-service bribes, as they often are in other countries where import licenses or construction contracts have well-known "prices" (cf. Gupta, 1992). This is not to say that straightforward bribery does not occur in China. It does, and participants in such an act may call it *guanxi,* but Chinese society widely scorns such *guanxi* (cf. Yang, 1994). Therefore, given the general expectation in China that gift giving will cultivate connections, we expected private-company executives to invest more in building the quality of their *guanxi* to protect themselves from the risks inherent in China's uncertain legal environment, and their expectations will be reflected in their gift-giving patterns.

> *Hypothesis 5: Executives in private Chinese companies will report giving more nonreciprocated gifts to those with whom they have business connections than executives in either state-owned or collective-hybrid companies.*

METHODS

Sample

The sample for this study was composed of managers in various industries from state-owned, collective-hybrid, and private companies in an interior Chinese city with a population of half a million people in late 1992. In China, it is difficult to find executives willing to talk openly about their *guanxi.* To overcome this problem, the first author drew the sample from the business connections of a close relative who is an executive for the state-owned insurance company in that city. Since all businesses in that particular region are required to obtain insurance policies from this insurance company, the manager of the insurance company had close connections with local businesses. The sample included heads and directors of key functional units (operations, finance, and marketing) in financial services, industrial manufacturing, textile manufacturing, transport, retail, and wholesale trade organizations. Only one executive declined to be interviewed. Interviewees were 15 state-owned-company executives, 8 collective-hybrid-company executives, and 9 private-company executives. We selected as wide a variety of industries as possible given the used to have all three types of company ownership possible in China in 1992 represented. We initially identified ownership status and industry using insurance company records and then confirmed them during interviews. We are aware that the demarcation lines between these legal ownership categories in China may, in practice, have become quite murky (for example, an executive of a state-owned company may direct the organization's resources to his private company, or a collective-hybrid may be a convenient legal designation for a privately controlled company). However, although such practices make it more difficult to find the hypothesized effects, they should not confound interpretations of supportive results. The average age of the interviewees was 41.7 years, and their mean tenure with their companies was 7.2 years. Eighty-one percent of the interviewees were men.

Procedures and Measures

Data were collected by means of a structured interview we first developed in English. In line with Brislin's (1986) recommendations, the instrument was translated into Chinese and back-translated into English to ensure accuracy of translation. To ensure use of up-to-date terminology and correct meanings for each item, we conducted two field tests with business students from China. Each interview, which lasted 60 to 90 minutes, started with the following statement: "We are interested in learning how managers develop their businesses and solve problems. In particular, this study focuses on ways managers work with others to get things done. . . .You and your organization will be completely anonymous. We are interested in general trends and will never release any information that could be used to identify you or the organization." Then, descriptive information was obtained about the managers and their companies (e.g., enterprise ownership, age, size). Next, the interviewer told the respondent this: "All managers rely on help from others outside their 'unit.' Managers deal with nonsubordinates, or those they have no hierarchical authority over, in efforts to develop their organizations as well as solve the day-to-day problems. Therefore, for the following questions, please be brutally honest. Your information will be used solely for research. Think of 8 to 10 individuals who are most useful in helping you succeed in this job. Think of those who are useful for day-to-day problems of your current job and those who are helpful to your long-run career success. These individuals are not necessarily the ones you 'like' the most or are close friends with, but those most necessary to your job and career success. Please exclude your direct subordinates from the list." All the interviewers but one identified eight individuals, with one collective-hybrid executive identifying ten. At this point the interviewees were asked to write a nickname for each connection onto a card the size of a business card (to provide anonymity for connections). A series of 27 questions was presented, and for each question the interviewees were asked to assign each of the "relationships" (the 8 or 10 cards in their hands) into the appropriate response category (e.g., 1 = deeply distrust, 5 = trust completely). The questions and response options relevant to this study are reported below.

Interviewees sometimes elaborated on an individual relationship with examples and comments. From the 32 interviews, we obtained data on 258 business connections. Table 1 gives means, standard deviations, and correlations among the studied variables.

The *importance of a connection* was assessed with the question, "How important is the relationship to you?" Executives rated relationships on a range from 1, "not important," to 4, "vitally important."

Whether a connection was a *defense against threats* was assessed by the executives' responses to the following statement: "This relationship is useful as a defense against threats," (1 = strongly disagree, to 5 = strongly agree). Whether a person offered a *government connection* was measured by responses to "What is the primary reason for the person's usefulness?" Responses were coded as 1 for "important connections in government" or as 0 for any of the following: "important connections in key companies," "important connections elsewhere in this company," "controls financial resources," "access to customers," "technical or professional knowledge," and "I have to go through this person." *Trust in the connection* was measured by asking, "To what extent do you trust the person?" (1 = deeply distrust, 5 = trust completely). The variable called *give connection gifts* was assessed by the following question: "People in business relationships often give one another gifts. Could you categorize these relationships by the form of gift giving between you and the other?" (1 = give connection nonreciprocated gifts or 0 = do not give connection gifts or give mutual gifts.) Because we were testing the hypothesis that executives in less structurally secure situation would have more need to strengthen their *guanxi* via giving gifts than those in more structurally secure environments, we focused on nonreciprocated gift giving.

Organizational age and *size,* the control variables, were assessed by asking for descriptive information in the first section of the interview. It is important to note that the organization referred to here is the business unit (e.g., an ink-manufacturing plant), not an entire company.

Validity Issues

Since data were collected by interview, all variables are single-item scales. Therefore, it was not possible to compute interitem reliability coefficients. Nor was it possible to tape interviews about such a delicate subject in a country with little tradition of confidential, disinterested social science research; thus, we could not compute interrater reliability coefficients for these measures. However, since interviewees sorted cards into categories visible to them on the desk, the interviewer was not required to make any

TABLE 1
Means, Standard Deviations, and Correlations Among Variables[a]

Variables	Mean	s.d.	1	2	3	4	5	6	7
1. Importance of connection	3.34	0.89							
2. Connection defends against threats	4.18	0.92	.51**						
3. Government connection[b]	0.37		.15*	.26**					
4. Trust in connection	3.94	0.86	.35**	.25**	.11				
5. Give connection gifts[c]	0.37		.29**	.19**	.35**	–.00			
6. Organizational age	14.06	12.17	–.13*	–.10	–.17**	–.07	–.00		
7. Organizational size	55.88	83.56	–.04	.11	.04	.07	.04	.28**	
8. State-owned company[d]	0.47		–.18**	–.13*	–.25**	–.12	–.13*	.77**	.21*
9. Collective-hybrid company[d]	0.25		–.11**	–.10	.16**	–.08	.04	–.32**	.07

[a] $N = 258$.

[b] Mean indicates that 37 percent of the relationships were useful for their connections in government.

[c] Mean indicates that 37 percent of the connections received nonreciprocated gifts.

[d] The three types of organizational ownership were dummy-coded, resulting in two variables. State-owned companies are coded as 1 in variable 8, and collectives are coded as 1 in variable 9.

* $p < .05$

** $p < .01$

assessments or inferences, a circumstance that provides some modest confidence in measure reliability.

As for construct validity, no prior information on the validity of these measures was available since they are new. We derived information on construct validity first through the responses and elaborations of interviewees, which provided a qualitative check on the executives' understanding of questions. We share some interviewee elaborations in the Results section, both to reflect the executives' understanding of the concepts being measured and to provide illustrations of the way business connections operate in China. Second, we sought preliminary support for the construct validity of these measures from confirmation of this study's hypotheses. Nunnally (1967) argued that an important test of measures' construct validity is whether the network of theoretically expected relationships is supported, and therefore, construct validity accrues over time from many studies.

Since each executive reported multiple connections, one potential problem is nonindependence of measures: there may be less variance within than between interviewee responses. We used a within-and-between analysis (WABA) (Dansereau, Alutto, & Yammarino, 1984; Yammarino & Markham, 1992) to test this potential problem. The corrected *F* from the WABA analysis was not significant for any variables. Variance existed both within and between interviewees on each variable, suggesting that it is appropriate to treat each connection as an independent unit. This test also contributed to evidence for the measures' construct validity.

Finally, since managerial level might affect the kinds of connections executives have (we sampled from two levels), we tested for effects of such differences on the study variables for each of the ownership types. Results of *t*-tests indicated no significant differences on any study variable between general managers and functional managers, the two types of interviewees.

RESULTS

To test Hypotheses 1, 2, and 4 and to identify specific differences on each variable across the three different ownership types, we performed one-way analysis of variance using Scheffé's multiple range test for comparing pairwise means. The first hypothesis predicts that executives in private companies will report that their business connections are more important to their success than will executives in either state-owned or collective-hybrid companies, given controls for company age and size. As Table 2 indicates this hypothesis was supported. Private companies in China were more likely to be newer and smaller than the collective-hybrids and state-owned companies, with the state-owned companies significantly older than the other two (mean age was 24 years for state-owned vs. 7 years for collective-hybrids and 3 years for private companies, $F = 198.23$, $p < .01$), and the private companies were significantly smaller (a mean of 16 employees, vs. 75 in state-owned and 66 in collective-hybrid companies; $F = 13.02$, $p < .01$). Nevertheless, we found that, even after we controlled for the companies'

TABLE 2
Results of Analysis of Variance and Cell Means[a]

Variables	State-Owned Company Connections	Collective-Hybrid Company Connections	Private Company Connections	Sum of Squares	*df*	*F*	η
Importance of connection[b]	3.17	3.18	3.79	19.59	2	13.63*	.31
Error	(0.96)	(0.91)	(0.50)	181.73	253		
Connection defends against threats	4.05	4.03	4.53	11.99	2	7.03**	.23
Error	(0.99)	(1.02)	(0.67)	218.48	256		
Trust in connection	3.83	3.82	4.23	8.61	2	6.00**	.21
Error	(0.81)	(1.05)	(0.68)	183.53	256		
N	120	66	72				

[a] Numbers in parentheses are standard deviations. For all variables, private-company executives' values are significantly higher than those of state-owned and collective-hybrid executives at $p < .01$.

[b] This was an ANCOVA test with controls for the covariants organizational age and size. However, these covariates were not significant.

* $p < .05$

** $p < .01$

relative youth and small size, executives in private companies apparently did seek to compensate for their relative lack of formal structural support by relying more on their *guanxi.*

Similarly, data reported in Table 2 support Hypothesis 2. Executives in private companies reported significantly more use of their connections to protect against threats than did either collective-hybrid or state-owned company executives.

Logistic regression analysis was used to test Hypotheses 3 and 5 because the dependent variables in these cases were dichotomous (Norusis, 1990). This test partially supports Hypothesis 3. The model chi-square tests the null hypothesis that the coefficients for all of the terms in the current model except the constant would equal zero. This procedure is comparable to the overall F-test for regression analysis. In this case, the model chi-square for government connections is 16.34 ($p < .01$), which indicates the main effect in this model is significant. Since there are three categories of independent variables, we used a two-parameter coding in this analysis. When ratings by private executives were compared to those of state and collective executives, the coefficient was 0.99 ($p < .01$). When ratings by collective executives were compared to those of state and private executives, the beta was 4.15, $p < .001$. From the two parameters (two dummy variables for three different ownership structures), it can be seen that managers from privately and collectively owned companies are more likely to have government connections than executives from state-owned companies. The collectively owned companies may need government connections as much as the private companies because many scarce resources are still controlled by the central government, and the local government officials with whom the collectives typically have close ties are not of much help in gaining these critical resources. The following interviewee quotations illustrate how private companies' executives use government connections. The first is from the general manager of a private computer company. "X," his administrative assistant, is the one of a high government official. The general manager hired X in order to strengthen his *guanxi* with the father.

> My company had bad luck. We were audited for income tax fraud. The Auditing Bureau has Red Eye Disease [jealousy]. Whenever they see a private company making money, they come and find trouble.
>
> The tax auditor just showed up one day and wanted to see company books. There are no standardized rules on how to keep books in China, especially for private companies like ours. If they want to find fault with your income tax, they will always find something wrong. If we had been found guilty of tax fraud, we could have faced thousands of yuan in fines and the possible suspension of our business license. All our hard work would have been gone like the wind. Our accountant was very worried. I called my administrative assistant, X, into my office and told him the situation. He smiled and said, "Give me a 2,500 yuan allowance [equivalent to a middle managers' six-month salary]

> and I will take care of everything." I had no choice. So I said, "I will give you 2,500 yuan, but you will lose your job if you cannot handle this crisis."
>
> By noon, my phone rang. X asked me to go to lunch with the auditors, at the best restaurant in the city. We hired a Mercedes Benz and went to lunch. The auditors kept saying that they only needed a working lunch. I was worried that X had gone overboard, but X was right. After expensive drinks and Peking duck, the head auditor started to praise our accounting system, saying how good and efficient it looked. This lunch lasted three hours and cost plenty, but it saved my company. After lunch the head auditor left me a notice requesting a 2,500 yuan income tax supplement. The reason he had to force us to pay the supplement was that he had to report to his boss on what he accomplished that day. Later on I found out that X's father is a good friend of the head auditor.
>
> There are too many threats for small companies like mine. There are no laws to protect you. The only way we can protect ourselves is through personal connections, trust, and being flexible. I hired X, a high school graduate, with his father's connections in mind. It does not sound right but everyone does it; you have to be open-minded.

Hypothesis 4 states that private-company executives would report closer *guanxi* with their business connections as reflected in executives' reports of greater trust in them. The results in Table 2 show that executives in private companies in fact reported their business relationships as characterized by greater trust than did the executives in state-owned or collective-hybrid companies. The following quotation from the founder and owner of a private textile trading company illuminates how important Chinese private-company executives feel it is to have trustworthy, responsive connections:

> In my mind, all business is connections and trust. That is all it is. No trust, no connections, no business. If you do not have connections to look after you at different levels of government, they can find excuses to suspend your business. The key connections I have are very close relationships. We have a kind of bond among us. As to how I maintain these relationships, I use various ways. I regularly invite people out to dinner, good food. You establish a good relationship, and help comes naturally—sometimes you don't have to ask. Relationships take a long time to build, and you need to maintain them.

Finally, executives in private companies were significantly more likely to report giving their business connections nonreciprocated gifts than were the executives of either state-owned or collective-hybrid companies, supporting Hypothesis 5. Although the overall model chi-square is only marginally significant ($\chi^2 = 4.673$, $p < .10$), with logistic regression analysis the two parameters indicate that private-company executives are more likely to engage in gift giving than executives from state-owned companies (private vs. state-owned and collective, $\beta = 0.63$, $p < .05$; collective vs. state-owned and private, $\beta = 0.45$, n.s.). By their own reports, these private business executives sought to use gift giving to build closer *guanxi.*

DISCUSSION

In interviews with executives in Chinese state-owned, collective-hybrid, and private companies we found, as expected, that private-company executives in this developing economy sought to compensate for their lack of formal institutional support by cultivating personal connections. Even after controlling for organizational age and size, we found that private-company executives' business connections were more important to them than the connections of collective-hybrid and state-owned company executives were to them. Further, as expected, private-company executives relied significantly more on building connections with government officials to defend themselves against threats like appropriation or extortion. Finally, the private executives made more extensive use of gift giving to build these connections and maintained business connections of greater trust than did executives in the more structurally secure collective-hybrid and state-owned companies. Private-company executives counteracted their formal structural disadvantages by building good *guanxi* with government officials as protection from unstable conditions. Thus, this test provides independent empirical confirmation of observations about the role of particularistic personal relationships as substitutes for formal structural supports in business relationships made by historians and sociologists such as Weber, Redding, Walder, Fallers, and Zucker. Although many have written of the necessity for good *guanxi* when doing business in China, few have placed this business practice into a theoretical context, and we are not aware of any empirical data systemically testing the role of gift giving in Chinese business relations.

Although the cultural role of gift giving has been analyzed extensively by anthropologists (e.g., Bell, 1991; Ekeh, 1974; Malinowski, 1922), not enough attention has been paid to the role of gift giving in business relationships (Bruhn, 1996). We hope this preliminary study of connections and gift giving in one society demonstrates the value of a better understanding of patterns of gift giving for those interested in international management research.

These results also offer potential insights into non-Chinese business settings. They support the idea that the "corruption" often decried by Westerners doing business in many developing and transitional societies (cf. Blunt & Jones, 1992; *Economist,* 1993a, 1993b; Gupta, 1992) is in part a consequence of weakly institutionalized structural protection for private business. As legal protection for private firms becomes established in China, tracking the changes there may provide a future experimental test of these ideas.

A structural approach to the issue of personal relationships in business has important practical implications. It suggests that forbidding what the

West calls bribery in societies in which gift giving is the expected way of building personal relationships would simply drive such actions further underground. If laws and reliable government cannot provide protection to those wishing to conduct business, businesspeople will seek to create their own protection, drawing on the means available to them. The interesting question is the extent to which a "culture of corruption" might be functionally autonomous, perpetuating such forms of gift giving beyond their structural utility. Future research might test these arguments in other developing countries.

Finally, this study opens up a relatively unstudied area of organizational behavior. Heretofore, the study of cross-organizational connections among executives has primarily focused on structural studies of formal interlocks or the "boundary-spanning" of scientists and engineers. As valuable as that work is, we hope this study demonstrates that cross-organizational connections are a fertile source of insights regarding organizations. As reliance on alliances and other forms of network organizations increases, cross-organizational connections also promise to assume increasing importance.

Several limitations of the current research should be acknowledged. First, although the WABA analysis indicated that it was appropriate to treat each connection as an independent unit, it did not remove the potential threat of nonindependence of observations in this study. Second, our use of many single-item measures makes it difficult to tease out the different dimensions of constructs such as trust. Also, the reliability of these single-item measures is unknown. Third, the sample used in this study was not randomized, so caution needs to be taken in generalizing its results.

In conclusion, this is a small, preliminary, empirical study addressing a large issue. Its context is a society undergoing massive economic upheaval, and it relies on single-item measures that are not independent. We hope future research will be able to address these questions in other settings with measures in which we can have more confidence. Nevertheless, these initial data do suggest promising new directions for international management research. They provide a provocative glimpse of the ways in which managers in structurally weak developing and transitional societies may build substitutes for the formal rule-of-law that managers in the developed world can take for granted. Patterns of gift giving, too, may be a rich vehicle for learning about business relations in different institutional contexts and could enlighten researchers as to the potential rewards of studying executives' connections outside their organizations.

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EFFECTS OF PROFITABILITY AND LIQUIDITY ON R&D INTENSITY: JAPANESE AND U.S. COMPANIES COMPARED

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This study investigates the proposition that Japanese companies have a greater propensity than U.S. companies to sustain commitment to R&D in the face of fluctuating profits and liquidity. The analysis showed that profitability declines led to increased R&D intensity in Japan. These effects were not confined to members of Japanese financial keiretsu, or industrial groups. The R&D intensity of U.S. companies fluctuated directly with two-year lagged profitability and liquidity variables, but these relationships might have been confined to more research-intensive companies.

It is sometimes observed that American companies respond to profitability downturns by reducing research and development expenditures (*Business Week,* 1991). Further, Thurow (1992) and others have proposed that the R&D expenditures of Japanese companies are less sensitive to profitability and liquidity fluctuations than the R&D expenditures of American companies. This tendency, if it exists, could place American companies at a disadvantage relative to Japanese competitors. Even though R&D cuts may increase profitability in the short term, a firm's rate of innovation may be slowed, and long-term performance will suffer. The effects that profitability and liquidity fluctuations have on the R&D expenditures of Japanese and American companies require empirical resolution. So far, no formal tests have been conducted. And, contrary to the usual presumption that incentives to cut R&D when profits decline dominate decision making about R&D, there are, as discussed below, forces that might lead firms to increase R&D when profits fall.

THEORETICAL AND INSTITUTIONAL BACKGROUND

Between-Country Differences in the R&D-Profitability Relationship

The conventional wisdom is that the relationship between R&D and profitability is positive in the United States and either positive but weaker, or nonexistent, in Japan. The arguments supporting this view have two major elements. First, U.S. firms rely more on internally generated funds to support their R&D. Second, key decision makers in U.S. firms have shorter time horizons, a characteristic that leads them to cut R&D when profits decline.

The greater dependence on internal funds of U.S. firms doing R&D stems from two problems that raise the cost of capital in markets characterized by arm's-length relationships between firms and investors. The first, an agency problem, arises because potential lenders perceive equity holders (who, past a point, will enjoy all the benefits if the payoff to an investment is high) as biased toward risky projects (Jensen & Meckling, 1976). Thus, loans will only be available at a premium. The second problem involves the costs to lenders of evaluating a firm's prospects (Myers & Majluf, 1984). These costs may be significant for R&D projects, which are often complex; in addition, the firm members who report on those projects may have individualistic career orientations that lead to exaggerated claims if they see their marketability being enhanced by a project that is a technical, if not a commercial, success. Finally, management will not fully disclose technical data in order to protect a firm's intellectual assets (Bhattacharya & Ritter, 1983).

Japanese firms may, however, be less dependent on internal funds because of interorganizational relationships that ameliorate the capital market problems that raise the cost of external financing. The principal relationship is the one between a company and its "main bank," which is both the firm's main lender and an equity holder (Hodder & Tschoegl, 1990). The main bank's equity holding mitigates the agency problem as the bank will not be disadvantaged by attempts to transfer wealth from lenders to stockholders. The main bank is knowledgeable about the firm, often providing expert guidance to it, so the costs of evaluating the firm's prospects are lower. The long-term commitment of the bank to the firm also means that the firm's managers will be less dependent on internally financing R&D as a way to protect intellectual property.

Although the internal funds vary with profitability, actual R&D allocations need not do so if managers, mindful of the long-term gains to R&D, insulate R&D from cash-flow fluctuations. It is widely held, however, that the time horizons of American managers and investors are often too short for this to occur (e.g., Hill, Hitt, & Hoskisson, 1988; Thurow, 1992). Because managers see their rewards as linked to short-term financial measures, they sacrifice R&D to maintain profits. And, critically, the U.S. stock market, rather than disciplining this behavior, may encourage it. According to Graves (1988), institutional investors whose investment decisions are strongly affected by short-term results dominate the market.

Japanese managers are expected to have both a longer-term and more company-specific orientation. This view flows naturally from the fundamentally different role that corporations play in Japan. Unlike the U.S. corporation, which is often seen as a vehicle for maximizing stockholders' interests, the Japanese company is viewed as a coalition of interest groups in which the interests of core employees and managers are at least as important as those of stockholders (Aoki, 1988). Accordingly, the priorities of Japanese companies differ markedly from those of U.S. companies. In particular, as Kagano, Nonaka, Sakakibara, and Okumura (1985) documented, Japanese top executives are much less concerned with stock price and give greater priority to market growth and new product development—priorities that imply their sustained commitment to R&D.

The lower priority Japanese managers place on stock price implies they will be under less pressure to cut R&D to preserve profitability. This tendency is supported by the nature of firm ownership in Japan, where a high percentage of equity is held by "committed" (Dore, 1987) stockholders, investors who do not actively trade their shares.[1] The stronger focus on long-term growth and new product development means that Japanese managers will attach more importance to R&D and therefore are more likely to sustain it even when resources are tight.

Several distinctive practices reinforce the long-term, company-specific orientation of Japanese managers and R&D workers. The effects of the lifetime employment system on the time horizons of Japanese managers are well documented (Abegglen & Stalk, 1985; Dore, 1987). Compared to their American counterparts, Japanese R&D specialists are more likely to identify with the long-term growth of their present employers. Like those of other employees, managers' career tracks involve a range of assignments, and advancement depends on a record of accumulated accomplishments rather than on specific individual achievements (Aoki, 1988; Sakakibara & Westney, 1985). The frequent transfers of personnel between central R&D units and operating divisions and the strong Japanese focus on ongoing process and product improvement results in less demarcation between core R&D personnel and other groups (Aoki, 1988; Odagiri & Goto, 1993).[2]

Could Declining Profits Cause R&D to Increase?

Although the preceding arguments are consistent with the usual conjectures about Japanese-U.S. differences in how profitability and liquidity affect R&D, they do not allow for the full range of effects. Indeed, it is possible that companies respond to declining profits by increasing R&D. Although a decline in profits reduces the funds potentially available for R&D, it may also signal impending organizational decline and prompt management to increase R&D in an attempt to ensure long-term firm viability. Such a response is consistent with the analysis of Mensch (1979), who attributed greater innovative activity during economic adversity to firm-level responses to declining profits in established markets. Inderrieden, Laczniak, and Pecotich (1990) found that R&D spending in a sample of Australian firms increased when past R&D efforts had failed and past economic performance had been poor. Hambrick, MacMillan, and Barbosa (1983) found that, although company cash flow negatively affected R&D intensity in U.S. companies in growth industries, the corresponding regression coefficient for companies in mature industries was positive (although not significant).

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[1] These stockholders include main banks and other companies in which a firm has reciprocal share holdings. Moreover, the types of institutional investors (mutual funds and pension funds) presumed to be sensitive to short-term fluctuations in profitability are much less important in Japan than in the United States. According to Aoki (1988), investment trusts and pension funds held just over 2 percent of the equity in all listed nonfinancial corporations in 1986. Stockholdings by financial institutions and other (nonfinancial) companies amounted to over 66 percent of all equity. Precise data for the United States are difficult to obtain, but the role of pension and mutual funds is much greater. According to Brancato (1990), investment trusts and pension funds held 42.7 percent of corporate equity in 1986. And it is generally held that institutional stockholdings have been increasing. Institutional investors held 46.6 percent of the equity in the top 1,000 U.S. companies in 1987, and 48.1 percent in 1989 (Brancato, 1990).

[2] Mansfield's (1988) data support the idea that Japanese R&D has been motivated by the pull of company needs and that U.S. R&D has been driven by the push for technical innovations. These data show that R&D personnel members suggested a higher proportion of R&D projects in American firms than in Japanese firms and that production employees and customers suggested a much lower proportion.

Within-Country Differences in the R&D-Profitability Relationship

Systematic differences in the relationship between R&D and profitability might occur between sectors in either or both countries. These within-country differences may help discriminate between alternative explanations of how profitability and liquidity affect R&D intensity.

Financial keiretsu membership. One influence on how profitability affects R&D intensity in Japan is whether or not a company is affiliated with a financial keiretsu, or group of allied corporations.[3] Some have advocated these alliances as a model of the type of interorganizational arrangement that would improve the competitiveness of non-Japanese firms (*Business Week,* 1990). Although the long-term relationships that Japanese companies have with other companies and with their main banks are sometimes regarded as ubiquitous in Japan, these relationships are much stronger for keiretsu members (Genay, 1991). Financial keiretsu employ a number of devices that reinforce interorganizational links: regular meetings of company presidents, top management exchanges, and the operation of group trading companies that play an important role in distribution, information gathering, and coordination of new ventures (Gerlach, 1992; Nakatani, 1984; Orru, Hamilton & Suzuki, 1989). Hoshi, Kashyap, and Scharfstein (1991) showed that the investments of independent companies were much more sensitive to variations in company liquidity than were the investments of keiretsu members, a finding indicating that the interorganizational relationships did indeed reduce the transaction costs problems that confront firms operating individually in external capital markets. Consequently, we expected that to the extent that interorganizational and main bank relationships attenuate such problems, the effects of profitability and liquidity variations on R&D intensity should be smaller for keiretsu firms than for other firms.

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[3] This study focused on financial keiretsu, which are distinct from vertical, or production, keiretsu, hierarchies of subcontractors supplying major manufacturing companies—some of which are members of financial keiretsu.

Research intensity. Different firms operate in areas that differ markedly in the degree of R&D required to compete successfully. Although research intensity is difficult to define and measure precisely, it is related to technological opportunity—the degree to which an amount of R&D activity will yield marketable innovation (Scherer, 1984; Wilson, 1977). Competing forces influence how research intensity affects the sensitivity of R&D intensity to profitability and liquidity. We would expect firms in highly research-intensive areas, where the ability to develop new technologies is likely to be a critical element of competitive advantage, to be more likely to sustain R&D investments despite fluctuations in internal funds. To the extent that firms seeking competitive advantage through developing new technologies have stronger incentives to sustain R&D investments even when funds are scarce, the size of any positive impact of profitability and liquidity on R&D intensity will be smaller in highly research-intensive firms. But to the extent that firms that compete on technology also have strong incentives to prevent appropriation of their innovations by relying on internal funding, the size of the positive impact of profitability and liquidity on R&D intensity will be greater the more research-intensive the firm.

METHODS

We used panel data to estimate regression models for each country and statistical tests to determine if the regression coefficients capturing the effects of profitability and liquidity on R&D in the United States differed from their counterparts in the Japanese model. The basic regression model for firm i at time t is:

$$(\mathit{R\&D\ intensity})_{it} = \alpha + \Sigma_x \beta_x\, \mathit{profitability}_{it-x} + \Sigma_x \gamma_x\, \mathit{liquidity}_{it-x} + \text{other variables},$$

where x is the "lag length" in years. Because we were testing assertions about the causal effect of profitability and liquidity on R&D, we included only lagged values (one and two years) of these variables in the regression equations. As in other studies of firm-level R&D expenditures (e.g., Bergh, 1993; Graves, 1988; Hansen & Hill, 1991; Long & Ravenscraft, 1993), the dependent variable, R&D intensity, was measured as expenditures on R&D divided by sales revenues. Profitability was measured as operating profits divided by sales, and liquidity as a firm's current ratio (current assets divided by current liabilities).

To ensure that the estimated coefficients accurately depict how variations in a firm's profitability and liquidity affect its R&D, we included a complete set of firm-specific dummy variables in each model. The firm dummies account for all between-firm variation in R&D intensity but leave all within-firm variation in R&D intensity available for explanation by time-varying variables such as firm profitability. This least-squares-with-dummy-variables (LSDV) procedure also removes the bias in the estimate of a coefficient on an explanatory variable that occurs when a variable that explains cross-sectional variation in the dependent variable and is also correlated with the explanatory variable is left out of the model (Hausman & Taylor, 1981). Thus, LSDV plays a particularly important role in this study. A positive cross-sectional relationship between R&D and profitability is likely because industrial sectors requiring high levels of R&D are likely to present high entry barriers (thus protecting the profits of incumbent firms) and be inherently more risky (thus requiring a risk premium for incumbents).[4] Since it is likely that all the variables producing a positive across-firm relationship between profits and R&D cannot be satisfactorily measured, the failure to estimate firm-specific effects would result in upwardly biased estimates of the profitability coefficients.

In some of the models we estimated (including those reported below), we included dummy variables for time to control for the effects of general year-to-year shifts or trends in R&D resulting from macroeconomic fluctuations, policy shifts, and other variables affecting the general level of R&D expenditures. In general, this analysis was analogous to Hoshi, Kashyap, and Scharfstein's (1991) analysis of investments by Japanese firms, which used both time- and firm-specific dummies to control for specification errors, including serial correlation. Some of our regression models also included a vector of explanatory variables that included proxy measures of firm size (such as sales and total assets) and capital intensity. As described below, these variables were nonsignificant in nearly all cases, and the estimates of the coefficients on the profitability and liquidity variables were not sensitive to their presence.

If profitability can have both negative and positive effects on R&D, the signs of the coefficients on the profitability variables, B_{jx} (for Japan) and β_{ux} (for the U.S.), are not certain. If R&D intensities are less prone to increase directly with profitability and liquidity in Japanese firms than in U.S. firms, then $\beta_{jx} < \beta_{\mathrm{ux}}$, $\gamma_{jx} < \gamma_{ux}$. Because there is no reason to expect that liquidity will have a negative effect on R&D, we expected that $\gamma_{jx} \geq 0$ and $\gamma_{ux} > 0$.

The analysis uses annual data on 454 U.S. and 177 Japanese manufacturing companies for the period of 1986–92. For the Japanese data, we began sample selection using the same companies analyzed by Nakatani (1984); these were then supplemented by an additional sampling of 50 firms traded on the first section of the Tokyo stock exchange. Observations were drawn from the relevant issues of the *Japan Company Handbook*. We took data for the U.S. manufacturing companies from Standard and Poor's COMPUSTAT data service. Companies that merged, were taken over, or went out of business during the period were not used. To be included in the final analyses, a company had to have all observations on all relevant variables for all years. Descriptive data indicate that the two samples are comparable in that they contain mostly large firms.[5] Moreover, as Table 1 shows, the Japanese and American firms are similarly distributed across two-digit industries. Table 2 provides summary statistics. The regression coefficients in Table 2 summarize the within-firm associations between the major variables used in the study.

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[4] The present data confirm the positive cross-sectional association between R&D intensity and profits. The correlation coefficients between profitability lagged one period and R&D intensity computed separately for each year of the study ranged from .19 to .26 for Japan and from .23 to .28 for the United States.

RESULTS

Cross-Country Differences

The first two columns of statistics in Table 3 give model estimates for the United States and Japan, respectively. Because we measured each variable in the same units for each country, we also estimated the cross-country difference in the sensitivity of R&D intensity to changes in each of the independent variables (third column). We calculated *t*-statistics of the following type for the difference between each coefficient in the Japanese regression equation and its counterpart in the U.S. regression:

$$t_{\beta x}=\frac{\hat{\beta}_{jx}-\hat{\beta}_{ux}}{\sqrt{\{[(n_j-1)\hat{s}^2_{jx}+(n_u-1)\hat{s}^2_{ux}]/[(n_j-1)+(n_u-1)]\}(1/n_j+1/n_u)}}$$

where $\hat{s}_{jx}$ *and* $\hat{s}_{ux}$ are the standard errors of the regression coefficients.

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[5] Average firm sales in 1992 (at prevailing exchange rates) were U.S. $3.7 billion for the U.S. firms and U.S. $2.3 billion for the Japanese firms.

TABLE 1
Industry Breakdown

Industry	Percentage of Firms United States	 Japan
Food and kindred products	4.4	3.0
Textiles & apparel	3.1	5.6
Paper & allied products	4.1	4.0
Chemicals & allied industries	11.0	12.9
Pharmaceuticals	5.2	7.3
Petroleum	4.4	1.7
Rubber & miscellaneous plastics	3.3	1.1
Stone, clay, & glass	1.7	2.8
Primary metals	3.7	4.5
Fabricated metals except machinery	5.0	3.4
Industrial & commercial machinery	17.4	14.0
Electrical goods	6.1	7.3
Consumer electronics	2.4	5.6
Communications equipment	4.1	3.4
Transport equipment	8.1	10.7
Instruments & precision equipment	9.6	6.1
Other miscellaneous manufacturing	6.4	6.7

TABLE 2
Means, Standard Deviations, and Regression Coefficients for Key Variables, 1988–92[a]

			Models			
Variables	**Mean**	**s.d.**	**1**	**2**	**3**	**4**
Japan						
R&D intensity	3.78	3.82				
Profitability$_{t-1}$	5.05	4.67	−0.025***			
			(2.17)			
Profitability$_{t-2}$	4.86	4.75	0.007	0.36***		
			(0.63)	(11.20)		
Liquidity$_{t-1}$	1.63	1.17	0.041	−0.157	0.42	
			(0.57)	(0.65)	(1.64)	
Liquidity$_{t-2}$	1.62	1.29	−0.14	0.04	0.005	0.005
			(1.59)	(0.95)	(0.26)	(0.24)
United States						
R&D intensity	3.38	3.78				
Profitability$_{t-1}$	12.88	6.64	0.006*			
			(1.75)			
Profitability$_{t-2}$	12.89	6.65	0.010***	0.38***		
			(3.51)	(20.76)		
Liquidity$_{t-1}$	2.20	1.13	0.024	0.38**	0.11	
			(1.27)	(2.49)	(0.78)	
Liquidity$_{t-2}$	2.20	1.13	0.042**	0.22*	0.32**	0.24
			(2.46)	(1.83)	(2.52)	(11.65)

[a] Coefficients are for the regression of the row variable on the column variable and firm-specific dummy variables (453 firm-specific dummies for the U.S. and 176 firm-specific dummies for Japan). For example, the regression of R&D intensity on profitability$_{t-1}$ and a complete set of firm-specific and time dummies for the United States yields a regression coefficient of 0.006 and a *t* of 1.75.

* $p < .10$, two-tailed test

** $p < .05$, two-tailed test

*** $p < .01$, two-tailed test

Estimates of regression models with and without the dummy variables for year produced similar results. In the U.S. model, the coefficients on the two-year lagged values of profitability and liquidity are positive and significantly different from zero ($p < .05$ and $p < .01$, respectively). In the Japanese model, the one-year lagged value of profitability is negative and significantly different from zero ($p < .001$). The tests for differences between coefficients show that Japanese R&D intensity is less inclined to rise and fall with profitability lagged one year than are R&D expenditures in the United States. The negative sign on $\hat{\beta}_{j1} - \hat{\beta}_{u1}$ derives from a negative Japanese coefficient, not from a larger, positive coefficient in the U.S. model. There are no significant U.S.-Japanese differences in the effects of liquidity on R&D intensity.

Because multicollinearity among the liquidity and profitability variables may have led to the nonsignificant coefficients in each of the country models (whereas, in a more parsimonious model, one or more previously nonsignificant coefficients may be significant), we tested alternative specifications. A backward-elimination variable selection procedure in which the profitability and liquidity variables were candidates for elimination produced a U.S. model with significant and positive two-year profitability and liquidity lags and a Japanese model with a negative one-year profitability lag. The coefficient estimates were only slightly different from those reported in Table 3 and supported the same conclusions regarding Japanese-U.S. differences.

The estimates reported in this article are from models that did not include any time-varying variables other than those for profitability and liquidity. These exclusions are justifiable on theoretical and empirical grounds: Most of the variables that previous theory suggests would belong in models of R&D intensity (e.g., company size measures) have been used to explain between-firm differences in R&D—not the within-firm variations that are the subject of this study. Between-firm variations (including effects due to industry-level factors such as market concentration) are already completely controlled for by the complete set of firm-specific dummies.

However, since variables that explain cross-sectional variations might also contribute to intertemporal variation in R&D intensity, we tested a number of models that included one- and two-period lagged values of other explanatory variables, including proxies for firm size (sales and total assets), and for capital intensity (the capital-to-labor ratio). The blocks of additional variables did not add to the explanatory power of the models and, except for

TABLE 3
Estimated Profitability and Liquidity Coefficients in Japanese and U.S. R&D Intensity Models[a]

Variables	United States	Japan	Difference	Interaction
$\text{Profitability}_{t-1}$	0.002	−0.045***	−0.047***	−0.047***
	(0.45)	(3.49)	(3.69)	(3.92)
$\text{Profitability}_{t-2}$	0.007*	0.004	−0.003	0.003
	(2.27)	(0.33)	(0.30)	(0.29)
Liquidity_{t-1}	0.017	0.010	−0.007	−0.008
	(0.81)	(0.15)	(0.11)	(0.12)
Liquidity_{t-2}	0.044**	0.056	0.012	0.010
	(2.73)	(1.31)	(0.23)	(0.25)
R^2	.98	.94		.98
F	169.19	69.36		266.79
n	2,270	885		3,155

[a] Models include an intercept term, dummy variables for five time periods, and a complete set of firm-specific dummy variables (453 for the U.S., 176 for Japan, and 630 for the interaction). Values in parentheses are t's.

* $p < .10$, two-tailed test

** $p < .05$, two-tailed test

*** $p < .01$, two-tailed test

the two-period lagged value of sales, which had a significant ($p < .05$), negative coefficient in the Japanese model, all were rejected when all continuous variables (including profitability and liquidity) were eligible for elimination under the backward-elimination variable selection procedure. The profitability and liquidity coefficients are not sensitive to model specification. The estimates from the most fully specified models were almost identical to those reported in Table 3. The models left after completion of the backward-elimination procedure also supported the same conclusions.

Further tests confirmed that the results are robust with respect to the measurement of the profitability variable. Models estimated with a return-on-assets variable (profits divided by total assets) produced results similar to those produced by models that used the measure of profits divided by sales.

American-Japanese differences were also estimated from a single regression model in which we pooled Japanese and U.S. observations and interacted a dummy variable, D_j (1 for Japan, 0 for the U.S.) with all time-varying variables. The main elements of the model can be represented by

$$(R\&D\ intensity)_t = \beta_1\ profitability_{t-1} + \beta'_1\ Dj\ profitability_{t-1} + \text{other variables},$$

where the coefficient on each interaction variable provides a direct estimate of the difference between the Japanese and U.S. model coefficients (i.e., $\hat{\beta}'_1 = \hat{\beta}_{1j} - \hat{\beta}_{1u}$, etc.) and, accordingly, permits a direct test of Japanese-U.S. differences in the sensitivity of R&D intensity to the variable in question. The interaction coefficients shown in the final column of Table 3 provide estimates of the differences between regression coefficients that are very close to those computed from the separate U.S. and Japanese models.

Effects of Keiretsu Membership

Table 4 shows results of models that test for the effects of keiretsu membership. Separate models were estimated for Japanese companies belonging to what Miyashita and Russell (1994) called the "old" keiretsu and "new" keiretsu. The old groups (Mitsui, Mitsubishi, and Sumitomo), which are directly descended from the zaibatsu—the giant holding companies that dominated Japanese industry before World War II—are characterized by a high degree of cross-shareholding with an average of 27 per cent of shares held by group members. The members of the new keiretsu (Fuyo, Sanwa, and Dai-Ichi), which were formed after 1964, mostly upon the initiative of major banks, have an average cross-shareholding of 14 percent,[6] and they are less dependent on their main banks than are the members of the old keiretsu. If strong interfirm links and main bank relationships did play a significant role in attenuating the sensitivity of R&D to profitability and liquidity changes, then keiretsu members would be less inclined to have a strong positive

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[6] We used the classification schemes of Nakatani (1984) and of Dodwell Marketing Consultants (1991) to categorize sample firms according to keiretsu membership.

TABLE 4
Estimated Regression Coefficients of Japanese R&D Intensity Models by Keiretsu Membership[a]

Variables	Old Keiretsu	New Keiretsu	Independents
Profitability$_{t-1}$	−0.062**	−0.023	−0.053**
	(2.10)	(1.21)	(2.61)
Profitability$_{t-2}$	0.002	−0.006	−0.006
	(0.05)	(0.34)	(0.30)
Liquidity$_{t-1}$	0.089	0.020	−0.048
	(0.05)	(0.24)	(0.37)
Liquidity$_{t-2}$	0.071	0.046	0.39
	(1.08)	(0.75)	(0.29)
R^2	0.93	0.94	0.96
F	29.78	49.28	59.67

[a] Models include an intercept term, dummy variables for five time periods, and a complete set of firm-specific dummy variables (80 for old keiretsu, 59 for new keiretsu, and 35 for independents). Values in parentheses are *t*'s.

**$p < .05$, two-tailed test

relationship between profitability and R&D intensity than independents, and this effect would be most pronounced for the old keiretsu members.

However, the coefficient estimates in Table 4 indicate no systematic difference between keiretsu and nonkeiretsu firms in how profitability and liquidity fluctuations affect R&D intensity. In each of the three groups, the one-year profitability lag is negative, and the coefficients for the old keiretsu and the independent firms are negative and significant ($p < .05$). These effects were robust across alternative model specifications. Application of the backward-elimination model selection procedure did not produce any additional significant variables in any of the models. The signs on the coefficients of the one-year lagged profitability variables were of approximately equal size for the old keiretsu and independent models when we excluded all other profitability and liquidity variables.[7]

Effects of Research Intensity

In the absence of a commonly accepted measure of research intensity, we divided both the Japanese and U.S. samples into three groups depending on the average R&D intensity of the companies over the years 1986–92. Firms with an average R&D intensity of less than 2 percent were assigned to a low group, those with 2–5 percent to a medium group, and those with more than 5 percent to a high-R&D-intensity group. The midpoint of the medium category is the approximate average of the R&D intensities for all firms for all years. We preferred this classification procedure to technological opportunity schemata such as Scherer's (1984), in which firms are assigned to subcategories based on industry level of technological opportunity. These categorizations are available only for the two-digit level, and some categories are so coarse that they group companies that differ markedly in degree of R&D intensity.[8]

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[7] The profitability coefficients (and associated *t*-values) are −.056, (2.06), −.026 (1.45), and −.052 (2.90) for the old keiretsu, new keiretsu, and nonkeiretsu firms, respectively.

As Table 5 shows, model estimates are fairly similar across all three Japanese groups. In each group, the first-period profitability coefficient is negative, and it is significant in the low- and high-research-intensity groups. None of the one-year profitability lags in the U.S. models is significant. The two-year profitability lag is positive and significant in the model for the highly research-intensive group. Tests of differences between coefficients confirm that for both the low- and the high-R&D-intensity groups, one-year lagged profitability fluctuations have a greater negative effect on Japanese R&D intensities than on American R&D intensities. There is no significant difference between Japan and the United States in the responsiveness of R&D intensity to liquidity fluctuations. As with the models estimated separately for each country, the presence of the additional explanatory variables did not affect estimates in any substantive way.

To illustrate the effects of changes in company profitability, we used the regression estimates reported in columns 1 and 2 to predict R&D intensity under alternative profitability scenarios for U.S. and Japanese firms characterized by average values of all other variables. Two successive years of zero profits reduced the R&D intensity of the average U.S. firm from 3.38 percent to 3.29 percent but increased the R&D intensity of the average Japanese firm from 3.82 to 4.01 percent. After two successive years in which profitability was one standard deviation below average, predicted R&D intensity fell from 3.38 to 3.31 percent for the United States and rose from 3.82 to 3.97 percent for Japan.

DISCUSSION

The results are broadly consistent with the widely accepted but previously untested proposition that the R&D intensities of Japanese companies are less inclined to move up and down with profitability than the R&D intensities of American companies. A significant part of the difference is a result of the tendency of Japanese companies to actually increase R&D expenditures when profitability declines. This is a provocative finding that deserves further investigation. On the one hand, profitability decline is a signal of incipient organizational downturn. If R&D is vital to long-term growth, even though the level of R&D required to maintain this growth is

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[8] For example, in the current samples, the stone, clay, and glass industry (which Scherer classified as low in technological opportunity) included some companies mainly involved in ceramics, where research intensity (and presumably, technological opportunity) is at a high level.

TABLE 5
Estimated Profitability and Liquidity Coefficients of Japanese and U.S. R&D Intensity Models by Average R&D Intensity[a]

	0–2%			2–5%			>5%		
Variables	**United States**	**Japan**	**Differences**	**United States**	**Japan**	**Difference**	**United States**	**Japan**	**Differences**
Profitability$_{t-1}$	0.001	−0.043**	−0.044**	0.00	−0.02	−0.021	−0.001	−0.064*	−0.064**
	(0.12)	(2.69)	(2.73)	(0.014)	(1.11)	(1.17)	(0.08)	(2.87)	(2.60)
Profitability$_{t-2}$	0.002	0.004	0.001	−0.003	0.017	0.014	0.024*	0.002	−0.02
	(1.08)	(0.322)	(0.165)	(0.52)	(0.90)	(0.74)	(2.21)	(0.078)	(0.95)
Liquidity$_{t-1}$	0.016	0.000	−0.02	0.070	−0.06	−0.01	−0.046	0.047	0.08
	(1.26)	(0.009)	(0.36)	(1.75)	(0.31)	(0.06)	(0.62)	(0295)	(0.40)
Liquidity$_{t-2}$	0.022**	0.033	0.004	−0.000	−0.05	−0.05	0.134**	0.078	0.06
	(2.06)	(0.93)	(0.11)	(0.10)	(0.24)	(0.24)	(2.077)	(1.17)	(0.65)
R^2	0.86	0.94		0.73	0.88		0.93	0.93	
F	23.86	71.78		9.88	15.32		51.10	28.89	
n	450	235		575	330		1,140	595	

[a] Models include an intercept term, dummy variables for five time periods, and a complete set of dummy variables for the firm-specific effects in each model. Values in parentheses are t's.

* $p < .10$, two-tailed test

**$p < .05$, two-tailed test

***$p < .01$, two-tailed test

uncertain, decreasing profitability may signal a need to increase commitment to the development of new technologies and products. On the other hand, increasing profitability may reduce the pressures for sustaining or increasing R&D levels.

The tendency of the R&D intensity of Japanese companies to increase when profitability declines is, however, consistent with the view of the Japanese firm as a coalition of stakeholders, each of whom has a significant interest in the longer-term growth and viability of the enterprise. Accepting the widely held presumption that increased R&D contributes to long-term viability, core employees (including managers and R&D professionals) expect lengthy tenures and will support a sustained or increased commitment to R&D. The corporate stockholders, who are often bound to a long-term relationship with the company (of which the stock holding is a part) will also view such a move positively. In contrast, the key players in the United States are likely to take a more individualistic, less firm-oriented view. Employees are less likely to make decisions to restore long-term corporate viability, and stockholders are generally less likely to be committed, as long as they can sell their stock.

It should be noted that the behavior of Japanese firms is based on a complex of mutually supportive structures, processes, and orientations of key stakeholders. However, the intercorporate relationships and main bank relationships associated with these keiretsu effects do not appear to play a critical role in the way that Japanese R&D expenditures respond to profitability changes. In particular, the intercorporate links associated with keiretsu membership to not appear to play a significant role. The finding that the R&D intensities of Japanese firms that operate independently of the main financial keiretsu are not more sensitive to profitability and liquidity fluctuations than the R&D intensities of the old keiretsu members implies that these interorganizational relationships, which have attracted considerable interest, do not play a determinative role. Accordingly, the explanation might lie in fundamental characteristics of Japanese companies themselves that directly result in a strong growth orientation and low pressure to preserve short-term profits.

The finding that it is in the highly research-intensive sectors that profitability variations positively affect the R&D intensities of U.S. companies also indicates the types of variables that determine a firm's response to profitability changes. It supports the argument that the presumably more complex nature of R&D in this sector increases the transaction costs faced by external investors (who in general do not have deep familiarity with the firms), thus increasing the reliance on internal funds.

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COLLECTIVE CLIMATES: A TEST OF THEIR SOCIOPSYCHOLOGICAL SIGNIFICANCE

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This article contributes to debate on the measurement of organizational climate. Use of means cloaks wide variations in individual perceptions. Use of clustering techniques to identify groups of people who see climate in a similar way has been questioned because such "collectives" may not represent meaningful sociopsychological groups. The present work is based on the view that meaningful collectives are most likely to emerge when people work together on common tasks in relatively isolated and defined physical locations. In an organization in which such conditions exist, a clustering technique largely failed to identify meaningful social collectives.

Organizational climates have been operationally assessed by aggregating individual perceptions for the appropriate collective group (organization, team) and using the mean to represent climate at that level of aggregation. Although researchers have acknowledged that criteria for accepting aggregate statistics as valid indicators of a social collectivity should be met (Payne, Fineman, & Wall, 1976), the precise nature of these criteria has been a source of controversy. For example, although the demonstration of significant mean differences has been extensively used as a basis for distinctive aggregate climates, researchers (e.g. Guion, 1973; James, 1982) have argued that this criterion is insufficient and that consensus of perceptions should be adopted for validation purposes. However, with the exception of Guion (1973) and Pace (1966), writers have not specified an appropriate level of agreement. Guion suggested that dichotomous questionnaire items should be used to measure climate and that the only items to be treated as genuinely descriptive should be those in which the frequency of endorsement is not significantly different from 100 percent or from 0 percent. Pace suggested that 66 percent was reasonable, but few researchers have complied with either prescription.

James (1982) reviewed studies addressing the extent to which individuals in organizations and organizational subunits agreed in their work-related perceptions. The indexes of agreement were based on estimates of interrater reliability, such as the intraclass correlation (ICC[1]) recommended by James (1982) for determining correspondence of ratings, and indexes of power from analysis of variance designs (n^2, w^2). Estimates of perceptual agreement were relatively low, ranging from .00 to .50, with a median of .12. Payne and colleagues concluded that "many studies of organizational climate lack validity since they do not show an adequate consensus by which measures could be said to validly describe organizations" (1976: 49).

BACKGROUND AND RESEARCH QUESTIONS

In response to the problems of demonstrating the validity of aggregate climates, Joyce and Slocum (1984) offered an alternative approach of combining individual perceptions of situational factors into clusters, reflecting similar climate scores, thus meeting the criterion of agreement. They termed such clusters defined only on the basis of individuals' perceptual agreement "collective climates." Following Payne and Pugh's (1976) suggestion, Joyce and Slocum formed collective climates using cluster analysis to classify individuals in an organization into groups whose members saw the organizational climate in similar ways. Each cluster had a high intraclass correlation coefficient (ICC [1]), indicating small within-group variance, and the criterion of discrimination between the clusters was met. Joyce and Slocum found that the clusters, or collective climates, differed in level of satisfaction and performance. However, Payne (1990) disagreed with Joyce and Slocum's claim that this finding demonstrates that the collective climates were meaningful subclimates.

Payne argued that for collective climates to have any conceptual ability in understanding organizational functioning, it is not sufficient "just that people see the organization in a similar way, but that the similarity is rooted in some formal, or informally structured collectivity" (1990: 78). That is, do the collective climates map onto the organization's social structure, such as work groups, departments, or more informal groups like cliques? Payne proposed that without a demonstration that the climates have a social meaning, they cannot represent a meaningful scientific concept. "Clusters of people who share common perceptions of their company might arise from such things as having similar personalities, values, interests, etc. To demonstrate that you can find clusters of people with similar views of their organization is no more than to demonstrate that clustering techniques work" (Payne, 1990: 78).

Jackosfsky and Slocum (1988) replicated and extended Joyce and Slocum's study and came closer to demonstrating the existence of meaningful climates with regard to Payne's comments. They undertook cluster analysis in an organization at one point in time (time 1) and approximately three months later (time 2). At time 1, they found four collective climates (groups of individuals who had similar views of the organization), and these clusters were related to departmental membership. However, this pattern did not repeat at time 2. Four collective climates were again found, but Jackofsky and Slocum did not find them related to any social identity.

At time 1 and time 2 there were strong correlations between climate and job satisfaction. Interestingly, as some individuals changed their perceptions of the climate between time 1 and time 2, so changing the makeup of the collective climates, there was a corresponding change in their levels of job satisfaction. Jackofsky and Slocum argued that the collective climates represented different sets of social experiences and that these affected the level of job satisfaction. However, a number of researchers have questioned the assumption that the causal flow between climate perceptions and job satisfaction is unidirectional, with climate perceptions affecting job satisfaction. For example, using complex modeling, James and Jones (1980) and James and Tetrick (1986) showed that the relationship between job satisfaction and climate perceptions was reciprocal. Indeed, job satisfaction appeared to a stronger cause of perceptions than vice versa. This relationship would appear to undermine the explanation offered by Jackofsky and Slocum to justify the meaningfulness of the clusters they found.

Schneider and Reichers (1983) considered three perspectives on the formation of climates. Firstly, according to the structuralist perspective, climates arise out of structural characteristics of an organization. Secondly, selection, attraction, and attrition of individuals produce homogeneous organizational membership resulting in similar climate perceptions. However, Schneider and Reichers highlighted a common problem with both these approaches. Neither explanation can account for the differences in climate found in many studies across work groups within the same organization. For example, Newman (1975) showed that employees in different departments described their climate differently. Similarly, Schneider and Bowen (1985) found that climate perceptions differed between work groups in a single organization. Further, Drexler (1977) measured perceptions of organizational climate in a large number of small units in the U.S. Navy and found that work group assignment could account for 42 percent of variance in climate, suggesting that in many of these work groups individuals had a consensus view of their climate.

Schneider and Reichers promoted a third perspective on the etiology of climates, one that accounts for work group differences in climate within a single organization. They drew on symbolic interactionism (Blumer, 1969) by suggesting that climate perceptions are a function of social interaction. Shared meaning evolves from the communicative interactions between individuals in a workplace. Since members of the same work group interact with each other more than with members of other groups, Schneider and Reichers argued that different work groups will generate different meanings regarding events, practices, and procedures that may be constant throughout the organization. Clearly, all three perspectives on the etiology of climates are complementary rather than competing, and each might be supposed to be more or less useful at different stages of climate development. Schneider and Reichers noted that cluster analysis would be a useful tool for testing the symbolic interactionist approach—that is, to test whether clusters of people with similar climate perceptions (collective climates) are related to interaction patterns among group members.

According to the interactionist approach, perceptual agreement among people in a work group will be greater the more intensive their interaction and the less opportunity there is for interaction with other organization members (Ashforth 1985; Schneider & Reichers, 1983). Thus, support would be provided for the interactionist approach if clusters based on perceptual agreement mapped onto work groups in which there is considerable within-group communication and little between-groups communication. This situation could be expected in work groups that do not require between-groups interaction for task completion. Additionally, Ashforth (1985) argued that strong physical boundaries, such as distant locations for each group, would increase group isolation and promote perceptual agreement and therefore further increase climate formation at the work group level within the same organization. Indeed, Jackofsky and Slocum (1988, 1990) adopted this interactionist perspective as a basis for understanding collective climate membership. They argued that the collective climates at time 2 of their study did not map onto any social grouping because there was high boundary permeability within the organization. All employees were located in the same building and performed multiple tasks that cut across formal group boundaries. This situation resulted in considerable interaction among members of all groups and therefore prevented the emergence of collective climates based on any organizational grouping.

In conclusion, cluster analysis is a useful tool for establishing composites of individuals that meet the criteria of agreement and discrimination. Indeed, collective climates (climates defined on the basis of individuals' shared perceptual agreement) are now accepted in the climate literature as one particular type or conceptualization of climate (for major reviews of the climate concept, see Glick [1985], Rousseau [1988], Schneider and Reichers [1983], and Schneider [1990]). There is a need to demonstrate that collective climates has a meaningful identity in terms of informal or formal organizational groupings before claiming it represents a valid description of a meaningful social construct. If statistical clusters of climate perceptions map onto what Payne (1990) called social collectives (people who have an identified social grouping), Payne's criticism of collective climates is undermined. Therefore, the main aim of this research was to address the conceptual validity of collective climates derived from cluster analysis.

As Schneider and Reichers (1983) suggested, we also used a clustering technique for defining subsystem climates (collective climates) to explore the interactionist perspective on climate formation. The question posed is this: Do collective climates map onto groups of individuals who are constrained to interact in a circumscribed physical location and work on common tasks that require their collaboration?

The Study

The research reported here is based on a sample of people drawn from two regional offices of a construction company located approximately 100 miles apart. Some members of the company's staff were physically located in each office. The rest of the staff worked as members of teams at construction sites within each region. As a result, the staff members at each site and each office were physically separated from most other staff members, inhibiting social interaction during work hours. The work groups on site were employed on distinct tasks and were independent from other work groups. Thus, no frequent work-related interaction took place between sites. Contact between office staffs and site staffs was necessary for task completion, but it was intermittent and usually indirect. Thus, there existed a number of work groups engaging in little, if any, between-group interaction.

We examined the conceptual utility of collective climates by ascertaining whether they were related to any form of structured collectivity within this organization. First, the association between collective climate membership and work group membership was considered. This was a very strong test of the validity of collective climates for a number of reasons. First, empirical research has repeatedly shown differences in climates between work groups within the same organization. Second, we deliberately sought a situation that facilitated within-work-group interaction and inhibited between-work-groups interaction, increasing the likelihood of different climates emerging. Third, proponents of collective climates (Jackofsky & Slocum 1988, 1990; Joyce & Slocum, 1979, 1984) have claimed that interactions play a substantial role in determining their memberships and that this phenomenon conceptually establishes the existence of collective climates. For example, Jackofsky and Slocum (1988) argued that collective climates emerge from work group membership if such membership defines the bulk of interactions between employees. Therefore, if clustering is a useful technique for determining theoretically meaningful subsystem climates, we would expect membership of the different collective climates to be associated with work group assignment.

Whilst the climate literature would suggest that if collective climates are rooted in any identifiable social collectives, they would be based on work group membership in an organization like the one studied here, we also compared collective climates to a number of other subgroups in the organization. Pritchard and Karasick (1973) demonstrated differences in climate perceptions across regions, so we investigated the relationship between collective climates and regional membership. Work environment perceptions have also been found to differ across roles and levels (e.g., Schneider & Synder, 1975; Stone & Porter, 1975). Therefore, we examined the organizational groupings of job type and hierarchical level in relation to collective climate membership.

The association between work group membership and collective climate membership was also used to examine the interactionist perspective on climate formation. As Schneider and Reichers argued, relating climates defined as consensus (collective climates) to the different interaction groups of which individuals are members is "a necessary next step in providing empirical support for a symbolic support for a symbolic interactionist approach to the etiology of climates" (1983: 36). This test is strengthened here by the work groups' physical isolation from one another, a feature that, according to the proponents of the interactionist approach (Ashforth, 1985; Jones, Rozelle, & Svyantek, 1985), should further promote the emergence of shared perceptions based on work groups.

METHODS

Sample

Data for this study were collected from 133 employees working in two regions of a nationwide construction company. Participation in the study was voluntary, and the sample represented 83.6 percent of the employees paid monthly in the two regions. Only construction sites with four or more people were included in the study. This restriction reduced the final sample to 114 employees. Region A employed 65 respondents, 21 in the office and 44 at five sites. Region B employed 49 people, 22 in the office and 27 at three sites.

Procedures and Measures

The research was conducted in conjunction with an effort by the organization to obtain employee feedback about its work climate. All respondents completed the same questionnaire, which took approximately 30 minutes. Employees were asked to fill out the questionnaire individually, seal it in an envelope, and return it directly to the researcher (one of the authors). We conducted interviews with regional managers and other senior personnel that probed for information about the company, its operations, and the degree of interaction between office and site personnel. We also visited two construction sites to determine interaction patterns among site workers.

On site, employees consisted of site agents, surveyors, engineers, and foremen. Completion of a project required a mix of the above functions on each site. There was a great deal of task interdependency for all site personnel, requiring frequent interaction between group members. On two sites visited by the researcher, there was socializing among all staff members during breaks. All sites were physically distant from each other, and people employed on the sites were carrying out independent tasks, inhibiting across-site work-related interaction and socializing during work hours.

Office employees in each region worked in the same physical location. The office for region B displayed limited segmentation, in terms of rooms and partitions, facilitating both social and work-related interaction among employees. Whilst dependency between office staff was less than it was on site, considerable coordination between the various functions was required. Face-to-face interaction between office and site staff was limited. The regional surveyors and managers visited each site approximately once a month. The contract managers demonstrated the most prominent link between office and site, frequently visiting the sites under their supervision. Approximately two or three times a year, each region held a formal social event to which all staff were invited. No interaction took place between regions except at the senior management level.

Questionnaire Measures

Each respondent provided data on tenure in the company, length of time at his or her current construction site, gender, age, region, particular office or site, and job type. We determined each respondent's hierarchical level by discussion with senior management.

The measure of organizational climate used in this study was the Business Organization Climate Index (BOCI; Payne & Pheysey, 1971). The index consists of 20 eight-item scales tapping aspects of organizational climate. Because instrument length was of concern to the organization, we decided to use 8 scales. The measure used a four-point response format that ranged from "definitely true" to "definitely false," rated 1 to 4. Subjects were asked to describe—not evaluate—the climate of the organization as a whole.

Assessment of the internal consistency reliability of each of the 8 scales using coefficient alpha led to the rejection of three items. After these rejections, the alphas ranged from .65 to .89 for the 8 scales. Table 1 presents means, standard deviations, and the internal consistency reliabilities of the scales. The names of the eight scales and an item illustrating each follow. (1) *Administrative efficiency* (eight items): "Work is well organized and progresses systematically from week to week." (2) *Rules orientation* (eight items): "Formal rules and regulations have a very important place here." (3) *Egalitarianism* (eight items): "There are no favourites in this place—everyone gets treated alike." (4) *Questioning authority* (seven items): "When people dislike policy they let it be known in no uncertain terms." (5) *Management concern for involvement* (eight items): "Senior personnel will go out of their way to help you with your work." (5) *Task orientation* (seven items): "People here follow the maxim 'business before pleasure.' " (7) *Readiness to innovate* (seven items): "New ideas are always being tried out here." (8) *Sociability* (eight items): "There are many opportunities for people to get together in planned social activities after hours."

The eight scales were chosen because they represented the four main

TABLE 1
Descriptive Statistics and Reliabilities for Measures

Climate Dimensions	Mean	s.d.	Reliability
Administrative efficiency	2.65	.50	.85
Rules orientation	2.92	.42	.73
Egalitarianism	2.88	.62	.89
Questioning authority	2.49	.40	.65
Management concern for involvement	2.86	.48	.83
Task orientation	2.81	.38	.72
Readiness to innovate	2.63	.41	.79
Sociability	2.64	.52	.83

factors of the BOCI as shown in Payne and Mansfield (1978). In order to maximize the possibility of obtaining consensus within clusters and differences across clusters, we decided to use all 8 scales instead of a smaller number of factors.[1]

Identification of Collective Climates

The purpose of cluster analysis is to identify homogeneous groups or clusters—that is, to sort cases (employees) into groups, so that the degree of association is high between members of the same group and low between members of different groups. In this study, individuals were clustered on the basis of homogeneous profiles for the eight climate scales.

We used both hierarchical and nonhierarchical clustering techniques. Clusters were formed by hierarchical agglomeration using Ward's method. This method replicates that used by Joyce and Slocum (1984) and was employed because it produces tight minimum variance clusters and is regarded as one of the best of the hierarchical clustering techniques (Wishart, 1987). At the first stage of such a procedure all n subjects are considered as separate clusters. At each subsequent stage in the clustering process, the two most similar or least dissimilar clusters are amalgamated. There are $n - 1$ clustering steps in all, and the final step produces one cluster encompassing all the cases. Ward's method chooses the two clusters at each step whose union leads to the least increase in the squared euclidean distance, which is defined as the total sum of the squared distances from each case to the center of the cluster to which it belongs. This grouping procedure minimizes the within-group and maximizes the between-groups sums of squares at each level in the hierarchical structure Ward's method presents the increases in the euclidean sum of squares resulting from each union. A large increase in the euclidean sum of squares indicates that clusters containing quite dissimilar members are being combined. Thus, this distance measure can be used for guidance in deciding how many clusters are needed to represent the data. We therefore terminated hierarchical clustering of individuals' climate data when there was a fairly large increase in the sum of squares. As a result, ten clusters were considered to be the most appropriate.

With hierarchical clustering, once a cluster is formed it cannot be split; it can only be combined with other clusters. Thus, hierarchical clustering methods do not allow cases to separate from clusters to which they have already been allocated, and nonoptimal clusters are generated. We therefore used a nonhierarchical clustering technique, Wishart's (1970) RELOCATE (a subroutine of the Clustan computer package), to improve the cluster solution. RELOCATE reduces the euclidean sum of squares for the clusters by reassignment of marginal cases. Each individual was removed from her or his initial cluster and tested with the other clusters. If relocation to an alternative cluster improved the solution (by reducing the euclidean sum of squares), the respondent was assigned to that cluster.

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[1] We are grateful to a reviewer for making this suggestion.

Two analyses were performed to assess whether the clusters could suitably be labeled collective climates. The clusters were first tested for perceptual agreement, and then for discrimination between clusters. As James (1982) suggested, we used the intraclass correlation coefficient ICC(1) to estimate perceptual agreement along the eight climate scales. The ICC(1) values ranged from .39 to .71. There are no clear guidelines for determining acceptable values of ICC(1), but as Howell (1992) indicated the squared intraclass correlation can be interpreted as a measure of effect size. In our case the ICC(1) of .39 for the scale questioning authority shows that there is much less agreement within the clusters for this scale than for egalitarianism, where the ICC(1) is .71. Following the practice of most other researchers, we report the levels of agreement (Table 2) and treat the mean scores as valid measures for each cluster (cf. Jackofsky & Slocum, 1988; Joyce & Slocum, 1984; Ostroff & Schmitt, 1993).

Multivariate and univariate analyses of variance (MANOVAs and ANOVAs) were carried out to determine if differences existed among the clusters climate means. Table 2 shows these results, along with the intraclass correlation coefficients. Not surprisingly, there are significant differences between the clusters (collective climates) along the eight climate scales used in this research, showing that the clusters differ significantly from each other and indicate different collective climates. Whilst we would not expect these ten collective climates to neatly line up with the ten sites, we would expect that this sort of social situation would optimize the chances of some of the collective climates mapping onto some of the sites.

RESULTS

The collective climates were examined to determine whether they had any basis in the organizational subgroups of work site, region, job type, and hierarchical level. Firstly, we examined the effects of the demographic variables (gender, age, and tenure) on collective climate membership. One-way ANOVAs indicated no significant differences between the climates on these variables.

The association of collective climate membership with work site, region, job type, and hierarchical level was examined via chi-square analyses because of the categorical nature of the positional predictors and climate membership. No relationship between the ten collective climates and ten work sites emerged. Neither was there any relationship with the two regions, the four hierarchical levels, or the ten job types. An overall examination of the collective climates revealed that respondents, grouped together on agreement of climate perceptions, were remarkable only in the diversity of the different organization segments (regions, construction sites, and offices) to which they belonged. None of the collective climates contained any groups that reflected the social structure of the organization. Thus, the collective climates had no basis in the organizational groups investigated here.

TABLE 2
Climate Dimension Means across Clusters and Analysis of Agreement[a]

	Climate Mean											
Climate Dimensions	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**ICC(1)[b]**	***F***
Administrative efficiency	3.18	2.18	3.15	2.53	2.08	2.43	2.59	2.16	2.63	3.05	0.59	17.4***
Rules orientation	3.58	2.61	3.08	2.97	2.55	2.64	2.64	3.03	2.70	3.29	0.57	15.7***
Egalitarianism	3.65	2.60	3.36	2.12	1.84	3.09	3.09	3.08	2.83	2.45	0.71	30.1***
Questioning authority	2.63	2.41	2.72	2.40	1.86	2.44	3.07	2.41	2.37	2.50	0.39	8.2***
Management concern for involvement	3.38	2.79	3.09	2.56	1.92	2.78	3.30	2.45	2.78	3.30	0.64	22.2***
Task orientation	3.14	2.30	2.85	2.90	2.38	2.53	3.16	2.98	2.84	2.96	0.42	9.4***
Readiness to innovate	3.12	2.32	2.64	2.23	1.73	2.70	3.21	2.16	2.91	2.51	0.65	22.5***
Sociability	3.09	2.78	2.89	2.28	2.00	2.03	2.47	2.89	2.76	3.34	0.61	18.9***

[a] Results of MANOVAs across the ten clusters for the eight dimensions of climate are significant.

[b] Intraclass correlation coefficients.

*** $p < .001$

The above results also have implications for the symbolic interactionist perspective on climate formation, because relating collective climates to interaction patterns of organizational members based on work groups provided no empirical support for this approach to the etiology of climates, at least if climate is operationally defined in the way used here.

We further investigated the interactionist perspective by examining the degree of agreement in climate perceptions among work group members using the intraclass correlation coefficient. Between-groups differences in perceptions were assessed by separate one-way ANOVAs for each climate scale and the significant ANOVA results were converted to ICC(1) to provide a measure of agreement. Table 3 shows the scales that differ across the work sites and the corresponding ICC(1) values. Work group membership was found to be significantly related to five of the eight scales, and the ICC(1) values for these scales ranged from .10 to .20. Although the ICC(1) values for four of the scales were higher than the median value of .12 that James (1982) reported in his review of studies addressing agreement on ratings of work environments, it is questionable whether the levels of consensus are significant enough for aggregation on any of the scales.

Finally, we undertook one-way ANOVAs to assess the level of agreement within the other organizational collectives of job type, hierarchical level, and region. No significant differences across regions and across hierarchical levels emerged for any of the climate scales, a result that precluded aggregation and calculation of ICC(1) values. Job type was significantly related to two of the eight climate dimensions (administrative efficiency and rules orientation); however, the resulting ICC(1) values were very low (.08 and .10).

DISCUSSION

Jackofsky and Slocum (1988, 1990) argued that collective climates are theoretically meaningful as they emerge out of the interaction of organizational members. The situational attributes of the construction company studied here provided clear indications of enforced interaction patterns among

TABLE 3
Significant Mean Differences in Climate across Work Sites and Analysis of Agreement

Climate Dimensions	*F*	ICC(1)[a]
Egalitarianism	2.46*	0.14
Questioning authority	2.69*	0.17
Management concern for involvement	2.35*	0.10
Task orientation	3.07**	0.20
Readiness to innovate	3.05**	0.18

[a] Intraclass correlation coefficients.

* $p < .05$

** $p < .01$

organization members. The physical isolation and task interdependencies of the work groups, especially those at the construction sites, defined the bulk of each respondent's work-related and social interactions during work hours as taking place within the individual's work group. However, the collective climates based on cluster analysis were not found to relate to interaction patterns as defined by these work groups. The clusters were populated by individuals from different offices, construction sites, and regions, with no evident consistency or pattern in their grouping emerging. Therefore, the collective climates appear to have no obvious sociopsychological meaning as many individuals in the same collectives did not interact with each other. Nor do the clusters reflect similar organizational experiences stemming from the same job content or hierarchical position.

The main justification for the empirical existence of collective climates is that high levels of perceptual agreement occur, thus allowing aggregation. However, if such consensus is not based in any organizational collectivity and no relationship is found with interaction patterns, then what meaning do they have? It is not sufficient to argue that a group of people have a common climate solely on the basis of their similar climate scores.

Clustering techniques will by definition find groups of people with similar perceptions, but such individuals may have similar climate scores for any number of reasons, such as similar "personalities, values, interests" (Payne, 1990: 78). Indeed, as was discussed, people's job satisfaction is one contributor toward particular climate perceptions. Thus, the conceptual utility of climates empirically defined by perceptual agreement but having no evident sociopsychological meaning is very much open to question.

An alternative explanation for our overall findings is that climate is not an organizational variable. If climate is viewed as only understandable at the level at which it is measured—the individual level—the aggregation of such data would be misleading and unjustified. This radical rejection of the organizational climate construct is not what we intend here, however, since there is evidence of agreement within collectives about perceptions of the environment. What we do question is the apparently misleading use of clustering techniques to determine climates defined only on the basis of perceptual agreement. Such methods do not guarantee that social collectivities are being mirrored in the data. Rather, as Payne (1990) suggested, they may simply mirror shared orientations based on aspects of experience and personality unrelated to organizational experience.

The concept of collective climate identified through the use of clustering techniques is now widely accepted in the climate literature; however, the results of this study undermine the view that collective climates represent a meaningful scientific concept and add weight to Payne's claim that "we need to be careful about the theoretical/conceptual conclusions we draw and should beware of applying statistical techniques without really thinking through the conceptual sense of the answers they create" (1990: 79).

Although the empirically generated clusters derived in this study did not map onto interaction patterns in an organization as defined by work groups, the ANOVA conducted across work groups revealed significant differences on five of the eight climate scales between work sites, as well as ICC(1) values ranging from .10 to .20. These results suggest that interaction processes are influential in determining work group members' climate perceptions. However, the empirical evidence does not support the view that work group members will necessarily come to share climate perceptions of general organizational issues through their within-group interactions and isolation from other groups. Rather, interaction would appear to be one influence that, along with individual and situational influences, determines members' perceptions (James, James, & Ashe, 1990). Social interaction and isolation may have reduced the variance resulting from individual and situational differences, but dissimilarity in climate perceptions remained.

The study has limitations preventing an unequivocal statement as to the validity of the interactionist perspective on climate formation. First, as a reviewer for this journal pointed out, although interaction taking place in isolated work groups could result in shared perceptions, it will not necessarily do so in ways that result in very different climates across the work groups. We did not address the issue of whether the work groups actually had experienced different local histories that might have compelled members to come to shared understandings that were very different from those of other groups. Physical separation and interaction might be required, but not necessarily sufficient, conditions to create distinct consensual climates.

A second limitation was that the survey items did not focus respondents on their work groups. As the primary aim of the study was to investigate the conceptual utility of collective climate, the climate questionnaire items were directed at the more macro level of the organization so as to encompass all subunits examined; thus, employees were asked to describe the organization and not their respective work groups. If the questionnaire had targeted the work groups, greater consensus might have been achieved. However, at least two studies exist in which people agreed they were members of work groups before being asked for perceptions of group climate. Indeed, team membership was established by use of sociometric techniques as well as reported agreement on team membership (Payne & Pheysey, 1971; Pheysey, Payne, & Pugh, 1971). Even in these groups, there were variations in perceptions of team climate. Jabri, Payne, and Pearson (1986) also studied team climate in small scientific teams and failed to show climate consensus by using clustering techniques. Indeed, the latter found meaningful subclusters within teams of only five to ten people.

Another factor that may have militated against producing higher ICC(1) values for the social collectives in this study is the relatively small standard deviations (see Table 1) across the whole sample (i.e., the whole organization). This finding might be interpreted to mean the organization as a whole had a homogenous climate. However, this interpretation is difficult to sustain as the cluster analysis in this study clearly demonstrates a lack of homogeneity in climate perceptions throughout the organization, as do the differences for five of the eight scales across work sites.

The relationship between two of the climate dimensions and job type in the present study provides support for the view that employees in different roles are subject to different experiences that influence climate perceptions (Adams, Laker, & Hulin, 1977). For example, Jones and James (1979) found greater similarity of perceptions among individuals in similar jobs from different naval ships than among those with dissimilar jobs from the same ship. Thus, heterogeneity of job type within work groups, as in this study, limits the communality of experience for individuals and thus influences the degree of consensus among members. Ashforth's (1985) discussion of the symbolic interactionist approach suggests that the impact of differing job types on agreement is explainable in terms of the interactionist perspective. According to social comparison theory, individuals prefer to compare their beliefs with those of similar others (Festinger, 1954). Individuals with similar job content and role requirements constitute "a more compatible and credible referent group" (Ashforth, 1985: 839). Ashforth argued that interaction "does not take place simply because the individuals are physically bound—as symbolic interactionism suggests—but also because of perceived interpersonal similarities" (1985: 839). Thus, conformity due to interaction may also be a function of similarity of job content and role requirements.

This research suggests that the meaning people attach to aspects of their work environment is in part a "property of the system of social interactions" (Glick, 1988: 134) but that that system is composed of different referents (team versus profession) and different types of interaction (face-to-face versus written interaction or other media). The interactionist approach does not, however, overcome the the problem of aggregation in climate research in terms of demonstrating within-group homogeneity. It is clear that there is a need to specify the unit of analysis on which an individual is asked to focus (job, team, organization, and so forth) and a need for careful consideration of whether the climate variables to be used are appropriate for the level of analysis. Although, again, it is questionable whether even such a considered approach will, in most situations, result in individuals agreeing among themselves sufficiently well for their aggregate score to truly represent their collective identity.

It is clear that members of groups (as opposed to empirically defined collectives) often fail to agree strongly about the nature of their group, but in many cases members agree enough to demonstrate that they see their group as different from other groups. The scientific challenge would seem to be to identify (1) factors in individuals that are associated with variations in perceptions of climate, (2) factors in environments that increase consensus, and (3) properties of groups that lead the individuals in them to develop a coherent view of their social world.

The logic of the present study was to find a situation in which organizational and physical circumstances defined who interacted with whom, and who did not interact with whom, under the hypothesis that doing this optimized the likelihood of the emergence of collective climates (climates defined on the basis of perceptual agreement) with a meaningful social identity. Clearly, they did not emerge, placing in doubt the utility of the collective climate concept for understanding organizational functioning and also calling into question whether social interactions play a substantial role in the creation of shared climate perceptions. However, future work pursuing the search for a high-consensus situation may well help in identifying some of the important factors relating to the three points made above.

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EMPLOYMENT VARIABILITY UNDER DIFFERENT MANAGERIAL COMPENSATION SYSTEMS

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Variability in employment levels, particularly when resulting from downsizing and layoffs, has considerable consequences for employees and organizations. Applying strategic compensation and agency theory principles to multiple years of employment, financial performance, and managerial compensation data on 152 organizations, we found that compensation design was related to employment variability through two avenues. First, organizations relying more heavily on long-term compensation incentives for managers exhibited less employment variability. Second, when groups of employees were covered by variable pay plans, their employment variability was lower.

Managerial compensation strategies differ significantly across organizations, particularly with regard to variable pay (Gerhart & Milkovich, 1990). In the reported study, we used strategic compensation and agency theories to examine the impact of organizational differences in managerial compensation on employment variability—the degree of variation in organizational employment levels over time. High employment variability has become commonplace among large U.S. firms of late as there has been a continuing trend toward downsizing (e.g., American Management Association, 1994; *Business Week,* 1996; Cascio, 1993; *New York Times,* 1996). Yet, some firms explicitly follow low employment variability policies. We suggest that a company's degree of emphasis on variable pay can determine its employment variability in at least two distinct ways. First, the decision of whether or not to reduce labor costs by engaging in layoffs can depend upon the extent of flexibility built into the pay system for those employees who are at risk (Gomez-Mejia & Balkin, 1992). Because performance-based labor costs are by definition tied to business outcomes, laying off flexibly paid employees during downturns may be less attractive than laying off people paid according to fixed wages. Second, as Gomez-Mejia and Balkin noted, the decision to downsize can also depend upon whether a variable pay design

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encourages decision makers to emphasize a long-term view of organizational performance. Decision makers can more heavily weight either the short-term labor cost savings of high employment variability or the potential long-term benefits associated with employment stability.

THE CONTEXT OF EMPLOYMENT VARIABILITY

The two potential effects of variable pay on employment variability warrant study because the strategic choice of whether to engage in practices such as layoffs can have considerable positive and negative consequences. By avoiding unnecessary employment variability, firms can reduce the substantial transaction costs (Williamson, 1975) associated with adding and cutting employees. The costs of layoffs can include severance pay, increased unemployment insurance taxes, and outplacement services (Bolt, 1983; Ward, 1982; U.S. General Accounting Office, 1985). If business conditions later improve, and significant hiring is required, the organization will incur all the costs associated with screening, selecting, and training employees with the necessary skills (Cascio, 1991), including the costs associated with "procyclical" hiring (hiring at times of economic growth) (Greer & Stedham, 1989). Additionally, the reputation as an employer of an organization that avoids unnecessary employment variability may be enhanced, potentially improving the firm's ability to attract and retain qualified employees. At the individual level, low employment variability may contribute to trust and flexibility among employees, which may increase acceptance of new technology, willingness to learn new skills, organizational commitment, and commitment to continuous improvement and quality initiatives (Deming, 1986; Dyer & Holder, 1988; Hayes & Jaikumar, 1988; Kochan & Osterman, 1994; Pfeffer, 1994; Schuler & Harris, 1991; Walton & Susman, 1987; Womack, Jones, & Roos, 1990). Recent empirical research at the individual level has linked layoffs with such detrimental effects on survivors as reduced loyalty, performance, organizational commitment, and trust (e.g., Armstrong, 1994; Brockner, Grover, Reed, Dewitt, & O'Malley, 1987; Brockner, Konovsky, Cooper-Schneider, Folger, Martin, & Bies, 1994; Richey, 1992).

As for the benefits of high employment variability, the major advantage stems from the fact that labor costs are typically the single largest operating cost in an organization (Cascio, 1993). During downturns, employment reductions can generate savings in direct labor costs that are immediate, measurable, predictable, and quite large. One study has indicated that such reductions translate to a positive stock market reaction (Worrell, Davidson, & Sharma, 1991). Failure to reduce employment levels when business slackens may jeopardize an organization's ability to compete in the product market as a result of cash flow problems. In general, it seems that high employment variability, particularly in the context of the decision to lay off employees, pits substantial and known short-term cost savings against the potential long-term costs associated with hiring, training, employee attraction, and diminished survivor trust and commitment. Hence, part of employment variability's attraction is that its short-term benefits are concrete while its long-term costs are vague and unpredictable (Dyer, Foltman, & Milkovich, 1985).

Given that the costs and benefits of high employment variability appear to have important implications at the individual and firm levels, the determinants of strategic decision making about it are of obvious interest. Figure 1, an exploratory model of employment variability, suggests three general determinants. First, the extent of an employee group's labor cost flexibility—also referred to as performance-based, variable, and incentive compensation—can potentially influence that group's employment variability by automatically linking the group's labor costs to the level of firm performance, reducing the appeal of layoffs during downturns. Second, the time horizons of the pay of managerial decision makers themselves may influence whether they take a long or short view in making decisions about the employment variability of other employee groups. We offer what we believe to be the first empirical examination of the issue and address both of these first two determinants in detail in the following sections.

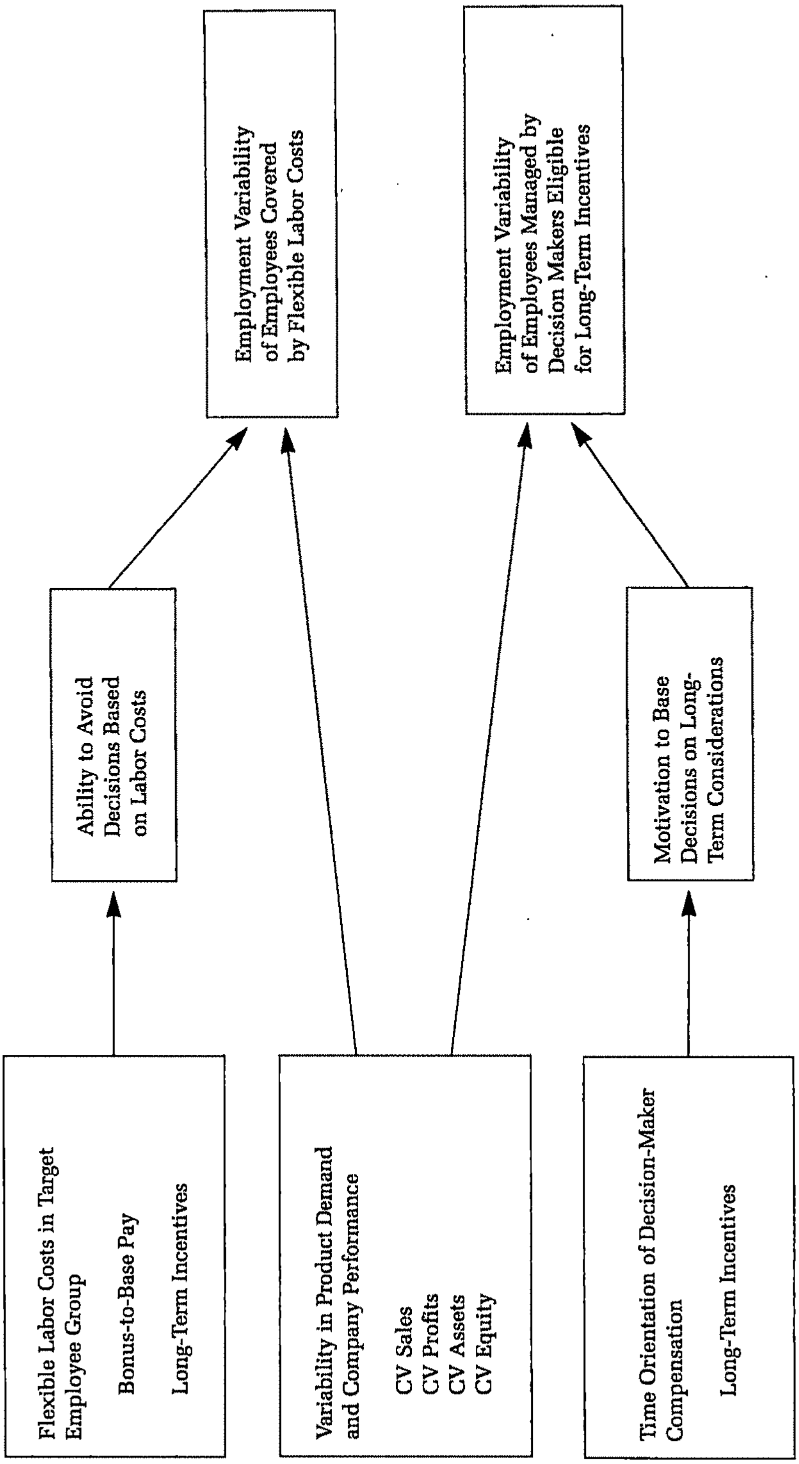
A third set of determinants of employment variability is variation in product demand and firm performance. The major challenge to employment stability is change in labor demand, which is a change in an organization's requirements for workforce size or skill composition (Dyer et al., 1985). According to labor economics theory, labor is a derived demand, meaning that change in the demand for employees (and subsequently high employment variability) is a function of change in the demand for an organization's product (Ehrenberg & Smith, 1994; Hicks, 1966; Marshall, 1923). An organization's performance should also affect employment variability. Successful performance implies financial resources that can be reinvested in an organization through hiring and optimally paying employees. In contrast, poor performance tends to correspond with a shortage of resources, which is often accompanied by the need to free them up through mechanisms such as layoffs. Thus, we controlled for the effects of variation in product demand and firm performance in order to better investigate the two pay-related determinants of employment variability.

CONCEPTUAL DEVELOPMENT AND HYPOTHESES

Labor Cost Flexibility

The notion of a flexible-labor-cost effect on employment variability lends itself to a strategic compensation framework. Strategic compensation describes the pay decisions that direct efforts toward strategic organizational objectives, require large resource allocations, and require consideration of internal and external contingencies (Gerhart & Milkovich, 1990; Gomez-Mejia & Balkin, 1992, Pearce & Robinson, 1982). For example, Balkin and Gomez-Mejia (1987) demonstrated how flexible labor costs can function as a strategic alternative to fixed wages. They found that firms needing the flexibility to apply resources to major initiatives used variable pay to avoid

FIGURE 1
A Model of Employment Variability


Flexible Labor Costs in Target Employee Group
Bonus-to-Base Pay
Long-Term Incentives
Variability in Product Demand and Company Performance
CV Sales
CV Profits
CV Assets
CV Equity
Time Orientation of Decision-Maker Compensation
Long-Term Incentives
Ability to Avoid Decisions Based on Labor Costs
Motivation to Base Decisions on Long-Term Considerations
Employment Variability of Employees Covered by Flexible Labor Costs
Employment Variability of Employees Managed by Decision Makers Eligible for Long-Term Incentives

having labor costs govern organizational decision making. In much the same way, the variable expense approach to compensation may protect against cycles of layoffs and hiring by providing a buffer against short-term financial pressure, allowing a firm to cut labor costs instead of employees in difficult times and to pay employees more when it is in a better financial position (Balkin & Gomez-Mejia, 1987).

A competitive strategy application to the strategic compensation framework also predicts a flexible-labor-cost effect on employment variability. According to the competitive strategy perspective, organizations must use their resources to cope with and exploit their environments in order to attain competitive advantage (Porter, 1980). One method for moving toward a competitive advantage is to create strategies that anticipate and respond to environmental changes. Applying this principle to compensation, one organizational resource for attaining advantage, Gomez-Mejia and Balkin (1992) cited the example of increasing variable pay to protect a firm against declining profits. The authors described such a strategy as fitting Porter's framework because it allows the organization to flexibly respond to anticipated demand shocks, rather than be forced into a more radical response, such as cyclical layoffs and hiring.

Agency theory's conceptualization of risk provides another basis for a flexible-labor-cost effect on employment variability. Agency theory (Eisenhardt, 1989; Jensen & Meckling, 1976) focuses on the contract that characterizes the relationship in which a principal (e.g., an owner) delegates work to an agent (e.g., a manager). The narrow aspect of agency theory that is applicable here is the notion that because agents, unlike principals, typically have their employment and financial viability tied to one organization, agents will generally be risk averse and, all else being equal, will select low-risk options (e.g., Baysinger & Hoskisson, 1990; Chatterjee & Lubatkin, 1990; Eisenhardt, 1989; Hoskisson, Hitt, & Hill, 1993; Hoskisson & Turk, 1990; Nilikant & Rao, 1994; Wiseman & Gomez-Mejia, 1996).

In the finance literature, it is well accepted that the risk associated with an investment increases as operating leverage (i.e., fixed costs) increases (Brealey & Myers, 1991; Lev, 1974). Specifically, the cash flow associated with a project, which is equal to its fixed and variable costs subtracted from its revenue, carries more downside risk (i.e., risk when revenue falls) when fixed costs are high. Hence, when a group of employees is paid under a variable, rather than fixed, compensation system, applying an employment stability strategy to the group should be a less risky proposition and, all else being equal, a more likely undertaking for risk-averse managerial decision makers.

In sum, our predicted flexible-labor-cost effect on employment variability emerges both from compensation strategy and from agency theory's concept of risk. Previous research on a flexible-labor-cost effect has provided mixed support. Chelius and Smith (1990) and Kruse (1991, 1993) found greater employment stability for firms with profit-sharing plans than for those without such flexible pay, but two recent studies (Bell & Neumark, 1993; Florkowski, 1994) reported little or no relationship between profit sharing and employment variability. However, although an ideal test of a flexible-labor-cost effect would measure variable pay emphasis and employment variability for the same employee group, both of the unsupportive studies attempted to predict total firm employment variability from the presence of profit-sharing plans that appeared to cover less than half of the employee base. Additionally, because the previous studies' dichotomization of labor cost flexibility (as the presence or absence of profit sharing) may have resulted in a substantial loss of both information and statistical power (Chelius & Smith, 1990; Cohen & Cohen, 1983), it is quite possible that the analyses conducted in the Florkowski and Bell and Neumark studies—as well as those in the supportive studies—would have found stronger evidence using an interval-level assessment of degree of variable pay.

In the present study, we were able to use an interval measure, and we attempted to more closely match our source of employment variability to the group eligible for variable pay. Additionally, by limiting our measurement of employment variability to exempt employees,[1] we were able to examine a portion of the workforce that has been a focus of recent attention because of widespread restructuring and "delayering" (eliminating levels of a management hierarchy; e.g., *Bureau of National Affairs* [1991]; Heckscher [1995]). Finally, we were able to move beyond using profit sharing alone and distinguish between the effects of short-term bonuses and long-term incentives, both of which should negatively affect employment variability by being regarded as variable pay substitutes for higher levels of fixed pay.

> *Hypothesis 1a: Employment variability among exempt employees will be lower to the extent that their pay is based on short-term bonuses.*
>
> *Hypothesis 1b: Employment variability among exempt employees will be lower to the extent that their pay is based on long-term incentives.*

Long-Term Orientation of Decision Maker Compensation

In the preceding discussion of flexible-labor-cost effects, we described how an employee group's pay can influence that group's employment variability. In contrast, our second hypothesis examines how the extent of long-term variable pay among those making decisions about employment levels influences the employment variability of the employee groups affected by these managers' decisions. This is a heretofore unstudied link between variable compensation and employment variability.

The potential for the time orientation of decision makers' variable pay to affect their decisions and the subsequent employment variability of those they manage is evident in applications of agency theory and strategic compensation. As noted earlier, agency theory focuses on the contract between principal and agent. Because both are self-interested but can have conflicting goals, and because the principal cannot always monitor what the agent is actually doing, the latter can engage in effort that deviates from the interests of the former (Eisenhardt, 1989). Because difficulty in monitoring agent behavior is the source of this agency problem, which is also referred to as a "moral hazard," principals use outcome-based contracts that rely upon imperfect information, such as data on firm performance, to attempt to remedy the moral hazard by aligning principal and agent goals (Holmstrom, 1979). The specific design of a compensation system is an important consideration (Gomez-Mejia & Balkin, 1992). Several studies have found support for the use of incentives in aligning principal and agent interests and alleviating moral hazard (e.g., Eisenhardt, 1988; Gomez-Mejia, Tosi, & Hinkin, 1987; Tosi & Gomez-Mejia, 1994).

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[1] Exempt employees can be defined as those not covered by the Fair Labor Standards Act because of their managerial or professional status.

In applying the moral hazard problem to employment variability research, we would expect that long-term incentives would lead managers to make employment variability decisions based on a long-term orientation. The orientation of managers should then be in alignment with that of the principals, who tend to be interested in maximizing firm performance (Tosi & Gomez-Mejia, 1989). Thus, it is likely that long-term incentives may result in employment variability decision making designed to further long-term performance. This orientation will likely make managers more cognizant of the transaction costs, loss of firm-specific human capital, and negative survivor reactions resulting from cycles of layoffs and hiring. Additionally, a long-term decision-making orientation should reduce the incentive for managers to transfer costs to employees in the short term by engaging in layoffs to improve the short-term appearance of accounting indexes (a potential employment variability example of the moral hazard problem). Consequently, managers under long-term incentives should be more likely to attempt to maintain stability in employment levels.

The relationships between long-term incentives and employment variability that we project from an agency perspective are consistent with a strategic compensation approach. Relative emphasis on long-term versus short-term objectives is an important dimension of compensation strategy (Gomez-Mejia & Welbourne, 1989; Lambert & Larcker, 1989; Rappaport, 1978; Salter, 1973; Stonich, 1981). U.S. managers have been routinely criticized for their short-term orientation (e.g., *Business Week*, 1986; Hayes & Abernathy, 1980; Reich, 1983), with the structure of their compensation packages often identified as a key culprit. Without long-term incentives, managers may bypass investments in areas such as research and development and employee development in favor of generating high short-term earnings (Hoskisson et al., 1993). Researchers have linked use of long-term incentives to "long-term outcomes" like R&D intensity (Milkovich, Gerhart, & Hannon, 1991) and capital investment (Larcker, 1983). Hence, such pay plans may extend the time orientation of management, fostering a greater concern for long-term investments in employees and thus inhibiting employment variability.

> *Hypothesis 2a: Employment variability among all an organization's employees will be lower to the extent that the pay of the managers who make employment decisions is tied to the long-term performance of the organization.*

It is possible that support for Hypothesis 2a could be in part the result of a flexible-labor-cost effect. That is, the variance in total employment variability explained by long-term incentives could be partially a result of the relationship between exempt employees' employment variability and exempt variable pay that was predicted in Hypothesis 1b. To attempt to better isolate how managers' long-term incentives influence the decisions affecting the employment variability of those they manage, we also tested for the effect of managerial long-term incentives on the employment variability of nonexempt employees. Because nonexempt compensation during this study's time frame was typically limited to base pay (e.g., Baime, 1990), this test provided an opportunity to more convincingly distinguish a long-term incentive effect from a flexible-labor-cost effect.

> *Hypothesis 2b: Employment variability among an organization's nonexempt employees will be lower to the extent that the pay of the managers who make employment decisions is tied to the long-term performance of the organization.*

METHODS

Sample

We used the Cornell Center for Advanced Human Resources Compensation Database, which contains data collected by a compensation-consulting firm between 1981 and 1985 on top and middle-level managers in over 300 business units and firms. Each organization reported yearly data on at least 50 individuals who were located within six reporting levels of its board of directors and were judged to be representative of the company's business units, managerial levels, and job disciplines. Consequently, the job families represented by the managers covered a broad range. All of the individuals in the sample were "managers" in that employees reported to them, and 80 percent had managers reporting to them. We compiled these individual-level data on the managers in the sample into organizational averages for the study's compensation variables (see the independent variable explanations). Across all firms, the organizational averages were based on over 10,000 individual-level observations in each year.

The organization was the unit of analysis for this study. To be included in the sample, an organization had to have participated in the survey for at least two consecutive years and be in a two- or three-digit Standard Industrial Classification (SIC) code industry that included at least 1 other organization. As a result, the final sample contained 152 organizations and organizational averages based on the individual managers' pay data. The average firm in the study employed approximately 30,000 people and reported about 4 billion dollars in annual sales. The database also includes corporate financial data derived from COMPUSTAT.

Dependent Variables

The three dependent variables were defined at the organizational level of analysis. The coefficient of variation in number of employees over the study's time frame was used to measure employment variability. We calculated this statistic for exempt employment to test Hypotheses 1a and 1b, for total employment (for Hypothesis 2a), and for nonexempt employment (for Hypothesis 2b). Because the employment-level standard deviation is divided by the employment-level mean to calculate the coefficient of variation, use of the statistic standardizes the variation units across firms of all sizes. Because organizations avoid employment variability by controlling both downward and upward variability (Dyer et al., 1985), we used the coefficient of variation rather than an indicator of head count reduction.

Independent Variables

Independent variables were also defined at the organizational level. The three managerial compensation measures, constructed from individual-level data, represent organizational emphases on long-term incentives, the ratio of bonus pay to base pay, and the level of base pay. Because organizational differences in employment variability can reflect different levels of investment in human capital (Chelius & Smith, 1990), we controlled for a human capital set of variables in each organization when constructing the compensation measures. First, we regressed each individual-level compensation variable on education, potential labor market experience (and its square), firm tenure (and its square), job tenure (and its square), number of levels between the individual's job and the board of directors, and number of managerial levels supervised. Each individual's residual then represented his or her value on the compensation variable in question (i.e., bonus-to-base ratio, long-term incentive eligibility, or base pay), relative to what would be predicted from the human capital and job characteristics. We then averaged the individual residuals across individuals within an organization to obtain the organization-level compensation variable value. Thus, an organization with a positive residual average paid higher compensation than the average surveyed organizations, with the personal and job characteristics of the individuals used to generate each firm's average controlled (see Gerhart and Milkovich [1990] for further information).

Although the these compensation measures were based on managerial data and represented aspects of organizational emphases on managerial pay for tests of Hypotheses 2a and 2b, they represented aspects of exempt compensation for tests of Hypotheses 1a and 1b. However, unreported analyses strongly indicated that how firms paid managers was highly indicative of how they paid the entire exempt population.

Long-term incentives eligibility. This variable was operationally defined as the average number of employees eligible for performance-based payments that would not be available to those employees during the next year. Although this organizational average was constructed from a yes or no indicator for each employee, the residual estimation and subsequent averaging across individuals and within firms results in an interval measure of the organization's emphasis on long-term incentives.

Managerial compensation. For each employee, each firm designated base pay and a total amount of bonus payments made during the past year. Bonus pay was typically a function of individual and business performance combined. We used the *ratio of bonus to base pay* for each individual in the residual estimation and averaging process to create this organizational average indicating degree of emphasis on short-term bonus pay.

This organizational average for *base pay* was created from base pay information provided by each firm for each individual.

Control variables. Labor demand and employment levels are likely a function of product demand and firm financial performance (Dyer et al., 1985; Ehrenberg & Smith, 1994). Because our dependent variables involve change in employment levels, we controlled for change in these two determinants. Product demand variation was represented by the *coefficient of variation of sales,* which was used as a proxy for product demand by Florkowski (1994). We used the *coefficient of variation of profits, stockholders' equity, and total assets* as indicators of change in firm performance (the coefficient of variation of total assets also served as a rough proxy for mergers, acquisitions, and divestitures). Additionally, we controlled for absolute levels of product demand and firm performance by including the mean (over the study period) of sales, profits, equity, and assets. Because negative profits result in negative coefficient of variations, a constant (2,000,000) was added so all profits would be greater than zero.

Firm *size* represented by the mean number of employees over the study period.

Industry dummy variables were based on either two-digit SIC codes or, where possible, the more precise three-digit categories. For 63 percent of the dummy variables we used three-digit codes, and at least two firms were present in each industry category.

Analyses

To strengthen causal inference, we measured compensation at a time $t-1$, product demand and performance (sales, profits, equity, and assets) at time t, and employment at time $t+1$ for each organization-by-year observation. In actuality, because of strictures on the timing of data collection, compensation year is less than one and two years from performance year and employment year, respectively. For a firm to be in the final sample, at least two complete organization-by-year observations (mean = 3.6 observations,

TABLE 1
Means, Standard Deviations, and Correlations[a]

Variables[b]	Means	s.d.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. CV total employees	0.10	0.09														
2. CV exempt employees	0.13	0.11	.49													
3. CV nonexempt employees	0.11	0.10	.89	.50												
4. Long-term incentives[c]	−0.49	0.27	−.20	−.16	−.22											
5. Bonus-to-base ratio[c]	−0.98	0.09	−.03	−.15	−.07	.12										
6. Base pay[c]	0.05	0.18	−.08	−.01	−.09	.22	.13									
7. CV sales	0.12	0.10	.38	.27	.31	.02	−.04	−.13								
8. CV profits	0.04	0.06	.11	.28	.21	−.05	−.04	.36	.12							
9. CV assets	0.14	0.11	.24	.22	.17	−.07	.08	−.02	.41	.09						
10. CV equity	0.16	0.24	.27	.22	.26	−.14	−.05	−.03	.31	.30	.19					
11. Sales[d]	3.97	8.67	−.01	.01	−.03	.08	.02	.48	−.09	.38	.00	−.07				
12. Profits[d]	0.22	0.44	−.06	−.01	−.09	.10	.05	.45	−.08	.23	.02	−.11	.92			
13. Assets[d]	3.42	6.99	−.04	−.01	−.06	.07	.04	.52	−.12	.44	−.04	−.10	.95	.87		
14. Equity[d]	1.43	2.87	−.06	−.03	−.07	.09	.03	.52	−.12	.40	−.02	−.12	.97	.92	.97	
15. Size	29,424	37,220	−.06	−.01	−.10	.07	.11	.53	−.06	.39	.08	−.06	.57	.50	.69	.58

[a] $N = 152$; correlations above ±.15 are significant at $p < .05$, two-tailed test.

[b] CV = coefficient of variation.

[c] Reported means for firm averages of long-term incentives, bonus-to-base ratio, and base pay are multiplied by 100.

[d] Reported means for sales, profits, assets, and equity are in billions of dollars.

range = 2 to 4) had to be present in the database. These initial 547 organizational-by-year observations yielded 152 final cases (organizations) after we computed the adjusted compensation averages and the coefficients of variation for performance and employment. The impact of compensation design on employment variability was estimated by:

$$CV\ employment_j = performance_j\, W + compensation_j Z + u_j, \qquad (1)$$

where *j* is the organization, *performance* is a matrix of the coefficients of variation and means of financial performance and product demand (performance includes the mean of firm size and the industry dummies), *compensation* is a matrix containing the three organization-level compensation variables, W and Z are regression coefficient vectors, and *u* is an error term that includes unmeasured causes of employment variability. *Coefficient of variation employment* is the coefficient of variation of exempt employment in Hypothesis 1a and Hypothesis 1b, the coefficient of variation of total employment in Hypothesis 2a, and the coefficient of variation of nonexempt employment in Hypothesis 2b.

We tested hypotheses with all three compensation variables in the model to control for pay level. One-tailed statistical significance tests were used in evaluating the effects of variation in organizational performance and in testing the hypotheses because there were a priori predictions in these cases. The coefficients on bonus-to-base ratio and long-term incentives should be negative; those on the change in product demand variable (coefficient of variation sales) should be positive, as should those on the other performance variation measures (the coefficients of variation of profits, assets, and equity). For the other variables, we used two-tailed tests.

RESULTS

Labor Cost Flexibility

Table 1 presents means, standard deviations, and correlations for the study's variables. Table 2 presents the regression results for Hypotheses 1a and 1b, reporting estimates of Equation 1 using different sets of control variables and the coefficient of variation of exempt employment as the dependent variable. As expected, variation in exempt employment is related to both sales and profit variation in all models, indicating that changes in product demand and firm performance are key determinants of employment variability and important controls in studies of the phenomenon.

The negative coefficient on the bonus-to-base ratio is significant in all three models, supporting Hypothesis 1a and indicating that exempt employment is less variable in organizations that rely more heavily on bonuses in paying their exempt employees. The negative coefficient on long-term incentives in models 1 and 2 also indicates that exempt employment is less variable to the extent that exempt compensation is in the form of long-term incentives, supporting Hypothesis 1b. Thus, both findings support the notion of a flexible-labor-cost effect on employment variability.

TABLE 2
Results of Regression Analysis, Effects of Managerial Compensation on Variation in Exempt Employment[a]

Variables[b]	Model 1	Model 2	Model 3
Intercept	.070**	−.030	−.122
	(4.70)	(−0.27)	(−0.91)
Long-term incentives	−.047^{+}	−.051^{+}	−.042
	(−1.42)	(−1.53)	(−1.02)
Bonus-to-base ratio	−.151^{+}	−.145^{+}	−.193*
	(−1.63)	(−1.56)	(−1.69)
Base pay	−.017	.046	.040
	(−0.31)	(0.74)	(0.49)
Control variables			
CV sales	.185*	.174*	.231*
	(1.84)	(1.74)	(1.89)
CV profits	.461*	.646**	.601**
	(2.67)	(3.30)	(2.39)
CV assets	.118^{+}	.123^{+}	.128
	(1.44)	(1.49)	(1.22)
CV equity	.016	−.016	−.061
	(0.41)	(−0.38)	(−1.18)
Performance and size means[c]	No	Yes	Yes
Industry[c]	No	No	Yes
R^2	.183	.219	.401
Adjusted R^2	.143	.151	.067
p	.0001	.0004	.2162

[a] $N = 152$ organizations; statistics are unstandardized regression coefficients with t-values in parentheses; significance tests are one-tailed for all variables except the averages of performance and firm size.

[b] Long-term incentives, bonus-to-base ratio, base pay, performance, and firm size are organizational averages computed over the study period (see the text). CV = coefficient of variation.

[c] Entries indicate whether a model included the variable.

$^{+}p < .10$

$^{*}p < .05$

$^{**}p < .01$

The nonsignificant long-term incentive coefficient in model 3 of Table 2 may raise a question about the robustness of the support for Hypothesis 1b. The fact that model 3 is not statistically significant overall, however, indicates that the equation's estimates probably deserve less weight than those from models 1 and 2. We estimated model 3 as an attempt to maximize use of industry data, with 63 percent of the dummies specified at the three-digit SIC-code level. But such specification resulted in a low case-to-predictor ratio (152 cases and 54 predictors), which most probably contributed to the subsequent deterioration of the model's fit to the data (we saw the adjusted R^2 decrease with the addition of the industry dummies).

In response, we reconfigured model 3 in two ways. First, we reorganized the industry data at the two-digit SIC level and required at least three cases per SIC code for inclusion. Second, in an attempt to preserve some of the three-digit industry dummies, we also respecified model 3 so that any industry code with at least five cases was preserved. In both model 3 reconfigurations the case-to-predictor ratio was substantially improved, the overall test of the model was significant, significant negative coefficients emerged for both bonus-to-base ratio and long-term incentives, and the addition of industry controls did not improve model fit. In sum, although the statistical significance levels of the variable pay components are not strong, the results supporting a flexible-labor-cost effect on employment variability are robust to the extent that the relationship was apparent in several different models.

Long-Term Orientation of Decision Maker Compensation

Table 3 contains estimates for Equation 1 using the coefficients of variation of total and nonexempt employment as the dependent variables. The results are highly consistent for the three models within each dependent variable and for all six models across the dependent variables. The significant, negative coefficients on long-term incentives indicate less variation in both total and nonexempt employment in organizations that rely more heavily on long-term incentives for their top and middle-level managers. These findings support Hypotheses 2a and 2b. That is, an emphasis on long-term incentives may encourage managers to take a long-term approach to firm success by avoiding the quick fix associated with layoffs. Moreover, the finding that long-term incentives for top and middle managers negatively affect nonexempt employment suggests that the effect on total employment is not simply a function of the flexible-labor-cost effect depicted in Table 2.

DISCUSSION

Flexible-Labor-Cost Effect

Our finding that exempt employees experienced less employment variability to the extent that their pay was variable complements the findings of previous empirical studies (Chelius & Smith, 1990; Kruse, 1991, 1993). These earlier studies, as well as related unsupportive research (Bell & Neumark, 1993; Florkowski, 1994), were inspired by Weitzman's (1984) share economy theory. In Weitzman's framework, widespread profit sharing can reduce both unemployment and employment variability for an entire economy. What previous research actually tested was the microeconomic implication that flexible labor costs might result in lower employment variability at the firm level (Kruse, 1993). It is this implication, rather than Weitzman's macroeconomic theory, that our results support. Moreover, because we used, for the first time, two conceptualizations of variable pay and a population of exempt employees, we suggest that the flexible-labor-cost effect itself may be somewhat robust.

From a strategic compensation perspective, our results are consistent with Balkin and Gomez-Mejia's (1987) finding of more use of variable pay in firms requiring high financial flexibility. Also directly relevant to our re-

TABLE 3
Results of Regression Analyses, Effects of Managerial Compensation on Variation in Total and Nonexempt Employment[a]

	CV Total Employment			CV Nonexempt Employment		
Variables[b]	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Intercept	.054**	.146†	.152	.068**	.172†	.175
	(4.66)	(1.73)	(1.52)	(5.05)	(1.74)	(1.49)
Long-term incentives	−.069**	−.070**	−.069*	−.069*	−.072**	−.065*
	(−2.67)	(−2.74)	(−2.24)	(−2.30)	(−2.41)	(−1.81)
Bonus-to-base ratio	−.004	.011	.074	−.030	−.013	.055
	(−0.05)	(0.16)	(0.86)	(−0.37)	(−0.15)	(0.55)
Base pay	−.004	.032	.036	−.037	.016	.000
	(−0.09)	(0.69)	(0.59)	(−0.78)	(0.28)	(0.00)
Control variables						
CV sales	.292**	.294**	.294**	.246**	.246**	.202*
	(3.77)	(3.82)	(3.22)	(2.73)	(2.74)	(1.89)
CV profits	.069	.081	.059	.278*	.348†	.417*
	(0.52)	(0.54)	(0.31)	(1.80)	(1.89)	(1.90)
CV assets	.041	.058	.087	.008	.026	.045
	(0.65)	(0.91)	(1.10)	(0.11)	(0.35)	(0.49)
CV equity	.042†	.026	.042	.039	.017	0.32
	(1.42)	(0.82)	(1.09)	(1.14)	(0.46)	(0.71)
Performance and size means[c]	No	Yes	Yes	No	Yes	Yes
Industry[c]	No	No	Yes	No	No	Yes
R^2	.231	.270	.469	.186	.222	.430
Adjusted R^2	.193	.207	.173	.147	.154	.112
p	.0001	.0001	.0247	.0001	.0003	.0984

[a] $N = 152$ organizations; statistics are unstandardized regression coefficients with t values in parentheses; significance tests are one-tailed for all variables except the averages of performance and firm size.

[b] Long-term incentives, bonus-to-base ratio, base pay, performance, and firm size are organizational averages over the study period (see the text). CV = cofficient of variation.

[c] Entries indicate whether a model included the variable.

† $p < .10$

* $p < .05$

** $p < .01$

search is the Gomez-Mejia and Balkin (1992) application of Porter's (1980) competitive strategy perspective to variable compensation. Under this application, firms can use variable pay to strategically respond to environmental changes such as declining profits. In our case, it may be that firms that value employment stability intentionally use variable compensation to protect their human capital investments from demand shocks while retaining the financial means to avoid constrained decision making in other areas, such as research and development. Similarly, because many organizations that maintain stable employment attribute their commitment to a leader's philosophy (Dyer et al., 1985), it may be that organizations use incentive pay to retain flexibility while remaining consistent with an organizational culture and philosophy.

Additionally, the negative flexible-labor-cost effect on employment variability supported agency theory's notion of risk-averse decision making. As variable pay emphasis increases for a group, less risk is associated with the returns to stable employment for its members, thus increasing the probability of a low-employment-variability approach to that group. Moreover, the flexible-labor-cost effect indicates that group members experience lower employment risk as emphasis on variable pay increases, suggesting that risk sharing through compensation can yield dual levels of risk reduction.

Long-Term Orientation of Decision Maker Compensation

In demonstrating for the first time that different approaches to long-term incentives for decision makers can have employment variability consequences for the employees they manage, this study is consistent with agency theory and strategic compensation predictions. Together, these two related streams of compensation research project that long-term incentives can align owner and manager interests and result in managerial decisions that enhance an organization's long-term interests, such as employment stability. Hence, it appears that as with R&D investments (e.g., Hoskisson et al., 1993), to the degree that management values the expected long-term benefits of employment stability, long-term incentives can help link managerial decision making with long-term strategic goals.

Although the purpose of long-term incentives can be to overcome managerial risk aversion by aligning the risk orientations of agents with the interests of principals (Tosi & Gomez-Mejia, 1989), it may be that certain types of risk sharing increase, rather than decrease, managers' risk-averse behavior. Wiseman and Gomez-Mejia (1996) suggested that the degree of risk a manager bears can determine whether he or the makes decisions so as to minimize risk or to optimize the expected value of the outcome. For example, substantial risk to an agent, such employment loss, has been shown to promote cautious strategic decisions (e.g., Ahimud & Lev, 1981). Compared to employment loss, however, long-term incentives within the typical range would seem to bear low risk, thus supporting the notion that they influence decision making about employment levels by tying it to concerns for long-term firm success, rather than by increasing risk-averse behavior.

Future Research and Limitations

From a strategic perspective, this study suggests that firms have the option of explicitly addressing employment variability via pay policy. If low employment variability is a goal of a firm's business or compensation strategy, variable pay should be present, for both the target employee groups and decision makers (in the form of long-term incentives for the latter). But although our study documents the presence of variable pay effects on employment variability, it would be helpful to know where it is in the process of decisions concerning business strategy, compensation strategy, and compensation practices that employment variability considerations take hold. Similarly, research is needed to assess how decision makers weight these considerations relative to variable pay's impact on goal alignment, risk sharing, attraction, motivation, and attrition.

Although the focus of this study was on variable compensation and employment variability, future research should also consider potential determinants beyond those presented in our exploratory model (Figure 1). Dyer and colleagues (1985) interviewed representatives from organizations that were explicitly committed to employment stability. These firms engaged in several practices that would lend themselves to future employment variability studies, including increased training to meet changing demands, slow creation of new jobs in business upturns, and encouragement of voluntary leaves and retirement. Dyer and colleagues cited such practices as buffering employment stability decisions not only against changes in business performance, but also against structural and technological changes that emerge from continual competitive pressure to produce more with less.

Two additional research directions point to limitations in our study. Future employment variability studies should attempt to better separate the relationship between a flexible-labor-cost effect and a long-term-orientation effect. Although we were able to isolate these distinct phenomena to some extent, the possibility of some confounding remains because we did not have exact information on the pay structure of the exempt and nonexempt employee populations whose numerical variations over time served as our dependent variables. An additional limitation involved controlling for industry. Because our sample organizations indicated that they wished to be compared at the company level and reported company-wide data on managers, we were unable to examine the effects of pay on employment variability at the strategic business unit (e.g., four-digit SIC-code) level. However, the results of some unreported analyses may mitigate omitted variable concerns. We found no effect of diversification level on employment variability, and we found firm sales to be more predictive of variable pay policies than were unit sales. Nevertheless, it may be that different effects of pay on employment variability are present in strategic business units.

Throughout this article, we have refrained from explicitly addressing the critical issue of whether, all else being equal, employment stability is actually beneficial for organizations over the long term. At this time, little empirical research speaks to this question. However, in addition to the costs of layoffs at the organizational (e.g., increased transaction costs) and individual (e.g., diminished survivor trust and commitment) levels, a further consideration, recently receiving a great deal of attention in the popular business press (e.g., *Business Week,* 1996; *New York Times,* 1996), is the broader social toll taken by years of downsizing. This coverage reports a growing public mistrust of corporate America and a deepening anxiety and disillusionment associated with the apparent demise of job security. Whether or not such widespread concerns eventually contribute to employment stability's becoming a more valued outcome, our results suggest that variable compensation can be a strategic tool in its facilitation.

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GOVERANCE, OWNERSHIP, AND CORPORATE ENTREPRENEURSHIP: THE MODERATING IMPACT OF INDUSTRY TECHNOLOGICAL OPPORTUNITIES

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Corporate entrepreneurship is important for organizational survival, profitability, growth, and renewal. Data from 127 *Fortune* 500 companies show that executive stock ownership and long-term institutional ownership are positively associated with such entrepreneurship. Conversely, short-term institutional ownership is negatively associated with it, as is a high ratio of outside directors on a company's board. Outside directors' stock ownership somewhat mitigates the latter negative association. Outsiders, including stock owners, might lead companies away from internal product development, the traditional route to corporate entrepreneurship. Finally, an industry's technological opportunities moderate the associations observed between corporate governance and ownership variables and corporate entrepreneurship.

This study focuses on entrepreneurial risk taking in the largest U.S. industrial corporations. It examines the association of a company's governance and ownership systems with its level of corporate entrepreneurship, defined here as consisting of innovation aimed at business creation and venturing, and strategic renewal (Zahra & Covin, 1995). The study's argument is that the association of ownership and governance with corporate entrepreneurship is moderated by the level of technological opportunities that exist in the firm's major industry.

Over the past decade there has been a growing awareness that governance and ownership systems can significantly impact corporate entrepreneurship. Porter (1992) called for studies documenting the association of governance and ownership systems with entrepreneurial activity. Researchers have responded to this call by documenting the impact of these systems

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on research and development (R&D) spending and outputs (e.g., Baysinger, Kosnik, & Turk, 1991; Daily & Dalton, 1992; Graves, 1988). However, these studies have produced contradictory results. Additional research is, therefore, needed if the association of governance and ownership systems with corporate entrepreneurship is to be better understood. This study was intended to clarify these relationships and to contribute to the literature in three ways.

First, the study emphasizes executives' reports of their companies' corporate entrepreneurship, thereby providing additional insights into the determinants of managerial risk-taking behavior. According to March and Shapira (1987), executives define a risky choice as one that has a possibly poor outcome. Entrepreneurial projects meet this criterion because many of them fail, those that survive may take years to generate a profit (Block & MacMillan, 1993), and it is difficult to estimate their results a priori. Hoskisson, Hitt, and Hill also noted that "choices that contain the threat of a very poor outcome are ones that involve a departure from established operating *routines and procedures* . . . [as happens when] a firm tries to adopt an innovation . . . that requires a fundamental change in the way the firm operates" (1991: 298; emphasis in original). Implanting corporate entrepreneurship projects usually requires making fundamental changes in the company's culture, structure, and managerial styles (Zahra, 1991). As these changes create uncertainty, success cannot be achieved without the strong support of senior executives (Zahra & Covin, 1995).

Second, the study examines the association of different groups of institutional investors with corporate entrepreneurship. Rather than treating these owners as a monolithic group, as was done in past research, I recognized that different institutional owners often pursue different goals and, therefore, may view corporate entrepreneurship quite differently. Therefore, I grouped institutional investors in terms of length of investment horizons (Roe, 1994).

Third, the study explores the moderating effect of technological opportunities on the associations of governance and ownership with corporate entrepreneurship. This link is important because there is concern that prevailing governance and ownership systems often harm corporate entrepreneurship, especially in high-technology industries (National Academy of Engineering, 1992) and other industries that have great potential for innovation. These reductions in innovation and other entrepreneurial activities can undermine the global competitive position of U.S. companies (Franko, 1989).

THEORY AND HYPOTHESES

Corporate Entrepreneurship

Corporate entrepreneurship includes radical product innovation, risk taking, and proactiveness (Covin & Slevin, 1991; Miller, 1983). It also includes business venturing and "intrapreneuring" (Kuratko, Montagno, &

Hornsby, 1990) and organizational renewal (Sathe, 1989). A review of the literature by Guth and Ginsberg (1990) concluded that corporate entrepreneurship has two dimensions: innovation aimed at business creation and venturing, and strategic renewal. I adopted this definition in this article because of its conceptual clarity and comprehensiveness.

As a component of corporate entrepreneurship, innovation is a company's commitment to creating and introducing products, production processes, and organizational systems (Covin & Slevin, 1991; Lumpkin & Dess, 1996). Venturing means that the firm will enter new businesses by expanding operations in existing or new markets (Block & MacMillan, 1993). Strategic renewal refers to revitalizing the company's operations by changing the scope of its business, its competitive approach, or both (Stopford & Baden-Fuller, 1994; Zahra, 1993). Strategic renewal also means building or acquiring new capabilities and then creatively leveraging them to add value for shareholders.

Corporate entrepreneurship can enhance shareholders' value by creating a work environment that supports individual and corporate growth, giving employees an opportunity to use their creative skills, quickening a company's response to the market, and creating an organizational culture that fosters cross-functional collaboration. These changes in turn promote entrepreneurial efforts that create new revenue streams (Zahra, 1991).

Despite the potential contributions of entrepreneurial activities to value creation, executives may not support them. Such managerial risk aversion is a widely suspected cause of the perceived decline of the competitiveness of U.S. companies (Franko, 1989; Hoskisson & Hitt, 1994). Careerism and short-term-based reward systems may discourage executives' pursuits of corporate entrepreneurship (Jacobs, 1991). Although investors can usually reduce their risk by holding diversified stock portfolios, executives cannot always diversify their risk, and some entrepreneurial activities have a high probability of failure (Zahra & Covin, 1995), a factor that can depress a company's short-term performance and lower executive compensation. As entrepreneurial failures can also damage executives' reputations and increase their risk of unemployment, they may induce managerial risk aversion. To counter this aversion, shareholders should use boards of directors to monitor executives to ensure a focus on long-term value creation.

Using corporate entrepreneurship as a lens to study managerial risk taking has several advantages. Notably, measuring such activity allows for a more comprehensive variable than the risk-taking proxies commonly used in the literature, such as R&D spending. Multiple manifestations of managerial risk-taking behavior can be examined, and their simultaneous relationships with corporate governance and ownership variables can be documented. Further, corporate entrepreneurship projects usually have longer time horizons than the activities on which the measures used in past research—such as R&D inputs and outputs—are based. R&D–based measures may embody inaccuracies. For instance, high R&D spending may reflect internal inefficiencies, whereby the firm consumes vast resources to generate new products or technologies, rather than risk taking. High R&D spending may also reflect high agency costs, with managers attempting to keep funds within a firm rather than distribute them to shareholders. Past researchers also appear to have assumed that high R&D spending means greater product or process innovations, which is questionable (Kochhar & David, 1996). Similarly, the number of a firm's patents does not always indicate the financial viability of those patents.

Corporate entrepreneurship projects often create information asymmetry between inside and outside participants in the corporate governance system. Specifically, because R&D spending figures are among a company's most widely publicized decisions, the financial community is likely to monitor them closely. This factor may limit managers' willingness to significantly reduce these allocations (Laverty, 1993). In contrast, some corporate entrepreneurship initiatives are invisible to external observers, a condition that may encourage managers to forgo investing in them. Some entrepreneurial efforts are like Burgelman's (1983) autonomous strategic behaviors: initiatives that complement a company's formal corporate entrepreneurship activities. Although some entrepreneurial activities may be incomprehensible even to insiders, executives are usually responsible for championing, evaluating, and integrating these projects into a company's formal initiatives. Insiders are, therefore, expected to have more data and more first-hand, tacit knowledge of entrepreneurial initiatives than outsiders. This information asymmetry between insiders and outsiders can affect the criteria used in evaluating corporate entrepreneurship. If financial criteria and controls are used exclusively, such activity may decline (Baysinger & Hoskisson, 1990).[1]

Agency theory suggests that corporate ownership and governance systems can affect managers' willingness to take risks (Jones & Butler, 1992). Ownership determines a company's relationship with shareholders and its investment horizons. When major shareholders exist, they can monitor executives' decisions and ensure attention to corporate entrepreneurship. Also, when investors own stock in a company for a long period, they are in a position to increase executives' interest in corporate entrepreneurship (Jacobs, 1991). The corporate governance system—the mechanisms that regulate the relationship between executives and shareholders—can similarly and profoundly shape managers' commitment to corporate entrepreneurship. Strong, vigilant boards of directors can encourage managers to support and pursue entrepreneurial activities.

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[1] It should be acknowledged that Baysinger and Hoskisson's propositions on the link of strategic and financial controls with corporate entrepreneurship have not been thoroughly tested, especially in reference to governance issues. However, ownership variables and their associations with different control types have received more empirical attention (e.g., Baysinger et al., 1991).

Governance and Ownership Systems and Corporate Entrepreneurship

According to agency theory (Jacobs, 1991; Zahra & Pearce, 1989), promoting corporate entrepreneurship requires increasing the representation of outside directors on a board, increasing outside directors' ownership interests to give them an incentive to monitor a CEO's commitment to entrepreneurship, increasing the ownership interest of a company's executives to align their goals with those of the shareholders, and ensuring the presence of a major shareholder that monitors the CEO and encourages the pursuit of corporate entrepreneurship. The next section of the article discusses the anticipated associations of these four variables with corporate entrepreneurship.

Insiders and outsiders' board representation. Aligning the interests of managers and shareholders requires active and independent boards, which can be achieved by increasing the representation of outside directors (Daily & Dalton, 1992; Judge & Zeithaml, 1992). A high ratio of outside directors on a board can expand the base of expertise from which a firm's CEO can draw, enhance objectivity in board deliberations, strengthen the system of corporate checks and balances, and increase directors' independence. It can also improve the board's ability to effectively perform its control function and encourage executives to pursue corporate entrepreneurship (Zahra & Pearce, 1989).

With a high ratio of outsiders, a board can tie executive compensation to the pursuit of corporate entrepreneurship and use commitment to it as a criterion in evaluating the CEO's performance. However, research does not universally support the presumed positive association between the ratio of outsiders on a board and corporate entrepreneurship. Indeed, some authors (e.g., Baysinger et al., 1991; Hill & Snell, 1988) have concluded that insiders' dominance on a board is positively associated with R&D spending, an indicator of corporate innovation. This finding is consistent with Porter's statement that "Boards, which have come to be dominated by outside directors with no other links to the company, exert only limited influence on corporate goals . . . . they often lack the time or ability to absorb the vast amounts of information required to understand a company's internal operations. Moreover, most directors have limited stakes in the companies they oversee" (Porter, 1992: 71). These observations also reinforce Kosnik's (1987) statement that "outside directors whose stock ownership in a company is small may have the same tendency to free-ride as small investors" (1987: 136). Lacking an ownership interest, outside directors may have little incentive to monitor a chief executive or promote entrepreneurial activity.

The fact that CEOs play a major role in the selection, remuneration, and retention of outside directors also limits outside directors' power. Currently, 80 percent of the CEOs of large companies also serve as their boards' chairs (Finkelstein & D'Aveni, 1994). Further, because most outside directors are themselves high-ranking officers of other companies, they may grant a CEO great powers (Roe, 1994). Shareholders have filed many suits against directors, but their accountability remains questionable (Jacobs, 1991). Directors have increased their coverage for liability and nearly 85 percent of U.S. public manufacturing companies have amended their bylaws to allow them to indemnify outside directors. These factors can insulate outside directors from the legal consequences of poor decisions.

Baysinger and Hoskisson (1990) observed that inside directors, through their participation in the strategic process, can more reliably assess the merits of corporate entrepreneurship projects. Outsiders, who are not usually as intimately involved in the strategy formulation process as insiders, may rely heavily on financial controls, which may lower corporate entrepreneurship. Inside directors are responsible for creating the administrative structures and the organizational culture necessary for corporate entrepreneurship (Burgelman, 1983; Zahra, 1991) and thus become familiar with these ventures. Insiders are also more capable than outsiders of achieving multifunctional coordination (Hill & Snell, 1988) and of promoting intensive interdepartmental communications.

Promoting corporate entrepreneurship in large organizations also requires changing prevailing corporate cultures and revising existing systems to overcome inertia. These changes frequently create considerable uncertainty, which also favors reliance on inside directors (Hill & Hoskisson, 1987). Also, because of their long-term association with a firm, insiders are usually informed about the sources and implications of this uncertainty. Inside directors are also positioned to observe the individuals and groups responsible for implementing corporate entrepreneurship and, consequently, can identify and address the sources of uncertainty. Further, given that they are typically responsible for monitoring and assessing industry changes (Galbraith, 1973), inside directors usually have access to information about the sources of uncertainty. This is important because entrepreneurial activities are likely to thrive in business environments characterized by dynamism and uncertainty (Zahra, 1991, 1993). Managing the uncertainty associated with or resulting from corporate entrepreneurship is a task best given to qualified inside directors (Baysinger & Hoskisson, 1990). Therefore,

> *Hypothesis 1: A high ratio of outsiders on a company's board of directors is negatively associated with corporate entrepreneurship.*

Involving outside directors through ownership. Outside directors' inability to monitor executives' commitment to corporate entrepreneurship may stem, in part, from a lack of ownership (Porter, 1992). However, outside directors who hold ownership interests will be motivated to monitor a CEO and will thus become more involved with a firm's operations. This in volvement can improve outside directors' use of strategic controls (Johnson, Hoskisson, & Hitt, 1993), possibly promoting corporate entrepreneurship: Hoskisson and colleagues (1993) found that when strategic controls were emphasized, managers usually supported risky projects. Given that entrepreneurial ventures can improve a company's performance, they can enhance the value of stock, so stock ownership may therefore further motivate outside directors to promote corporate entrepreneurship (Jacobs, 1991). Thus, stock ownership may weaken the association between the ratio of outside directors and corporate entrepreneurship predicted in Hypothesis 1. Although the effect on entrepreneurship of the interaction of outsiders' representation and their stock ownership should remain negative, the coefficient will be lower than that resulting from a test of Hypothesis 1. Therefore,

> *Hypothesis 2: Stock ownership by outside directors will temper the negative association between the ratio of outside directors on a company's board and corporate entrepreneurship.*

Executive ownership. Executives are sometimes viewed as being more interested in improving a company's short-term performance than in maximizing its long-term value (Jacobs, 1991). Because their compensation is usually based on short-term financial performance, executives may have little incentive to promote internal entrepreneurship, especially when they have low ownership stakes (Malatesta & Walling, 1988). Tying rewards to long-term corporate value can stimulate executives' interest in corporate entrepreneurship (Jones & Butler, 1992). Even though the above discussion suggests a positive association between executives' ownership and corporate entrepreneurship, past research has yielded contradictory results. Some researchers have found a positive but insignificant association between managerial ownership and R&D spending (Hill & Snell, 1988, 1989), and others have reported a positive association between these variables only within particular industries (Hansen & Hill, 1991). These conflicting results highlight a need for additional research on the issue. Still, it is noteworthy that none of the past studies reviewed has found a negative association between executive stock ownership and corporate entrepreneurship. Therefore,

> *Hypothesis 3: Executive stock ownership is positively associated with corporate entrepreneurship.*

Institutional ownership. The presence of a major powerful shareholder encourages a CEO to pursue risky long-term ventures such as corporate entrepreneurship (Jensen & Meckling, 1976). Institutional owners are fast becoming powerful players in the corporate governance system. Yet there is no agreement on the nature of the association between institutional ownership and entrepreneurship. Some authors have suggested that institutional owners will influence corporate entrepreneurship positively because they are better informed than other shareholders about the companies in which they hold stock (Baysinger et al., 1991; Hansen & Hill, 1991) and cannot always dispose of their holdings without a significant loss. Also, the rising activism of some institutional owners, coupled with several regulatory changes that have somewhat eased the requirements for waging proxy contests, have raised hopes that these investors will encourage corporate entrepreneurship. However, other authors have predicted a negative effect

(Graves, 1988), because institutional investors may be driven by short-term, bottom-line considerations.

These conflicting propositions on the association of institutional ownership with entrepreneurship may have arisen from researchers' tendency to view these investors as a monolithic group. This assumption should be empirically tested; different groups of institutional investors may pursue different goals and emphasize different objectives and investment horizons (Kochhar & David, 1996; Roe, 1994). In this study, I grouped institutional investors on the basis of their investment horizons. The first group includes mutual, pension, and retirement funds. Because of the large size and long durations of their investments, managers of such funds may be primarily interested in improving their portfolios' long-term value. Long-term ownership should promote corporate entrepreneurship (Roe, 1994).

The second group is short-term institutional owners, such as investment banks and private funds. These investors have been the subject of much concern in the literature. Because fund managers are evaluated quarterly, they may promote short-term investment horizons (Chaganti & Damanpour, 1991), a condition that might jeopardize corporate entrepreneurship. Further, fund managers usually focus on maximizing their portfolios' annual performance (Jacobs, 1991). If the value of a stock declines, fund managers may discontinue the investment rather than challenge management, a process that can explain frequent stock shuttling by these investors (Porter, 1992). Consequently, these investors are likely to pressure executives to overlook corporate entrepreneurship projects with long payback periods (Graves, 1988; Hill, Hitt, & Hoskisson, 1988). Therefore,

> *Hypothesis 4a: Long-term institutional stock ownership is positively associated with corporate entrepreneurship.*
>
> *Hypothesis 4b: Short-term institutional stock ownership is negatively associated with corporate entrepreneurship.*

Technological opportunities and the association of governance and ownership with corporate entrepreneurship. To date, researchers have ignored the moderating impact of industry conditions on the associations posited in Hypotheses 1 through 4, a practice that might have contributed to past contradictory findings. As industries vary in governance systems, investment horizons (Jacobs, 1991), and the pursuit of corporate entrepreneurship (Zahra, 1993), there is a need to document the impact of industry variables. The technological opportunities executives believe to exist in an industry can profoundly influence the predicted associations.

Industries vary considerably in their technological opportunities (Geroski, 1990), defined as executive's perceptions of ability to support and generate growth opportunities through product and process innovations. Industries with high levels of perceived technological opportunities are usually characterized by rapid and frequent product and process technology introductions and high levels of R&D spending and patenting. Conversely, industries low in technological opportunities are usually limited in their growth potential and report modest levels of R&D investments.

To succeed in industries with high technological opportunities, executives must quickly process large amounts of information on their competition, market, and customers (Galbraith, 1973). This condition favors having a majority of inside directors on a company's board, as implied in Hypothesis 1. Also, in these industries, a firm must take risks and engage in corporate entrepreneurship, spend heavily on developing products and technologies (Zahra & Covin, 1995), and accept long payback periods for its investments. These factors reinforce the need for highly motivated inside directors and managers who have a vested interest in the company through ownership, as indicated in Hypothesis 3. This ownership stake, which aligns the interests of the managers and shareholders, also bonds the former to the company and ensures steady leadership. Still, if outside directors serve on the board, companies should motivate them through stock ownership, as implied in Hypothesis 2. Finally, in industries with high technological opportunities, companies need long-term institutional owners who provide the patient capital necessary to exploit growth opportunities, as posited in Hypothesis 4a. Short-term institutional owners may pressure executives to forgo long-term investments in high-risk ventures, as implied in Hypothesis 4b. Therefore,

> *Hypothesis 5: Level of perceived technological opportunities will moderate the association between governance and ownership in such a way that the associations posited in Hypotheses 1 through 4 will be stronger in industries with high, rather than low, technological opportunities.*

METHODS

Data

Collection and sample. To test the study's hypotheses, I collected data from secondary sources and through a mail survey that was directed to the CEOs or the highest-ranking executives of the manufacturing companies on the 1988 *Fortune* 500 list. Two mailings, conducted one month apart in 1991, were used to enhance the response rate. A personalized letter accompanied each questionnaire, explaining the study's objective and assuring the executives of the confidentiality of their replies. Responses from 138 firms represented a response rate of 27.6 percent, which was consistent with expectations about this population (Tootelian & Gaedeke, 1987).

To test for absence of response bias, I compared respondents to the first mailing to respondents to the second mailing in terms of company size (assets in millions of dollars), return on sales (ROS), and responses to the survey items. The *t*-tests showed significant differences between the two groups on only two items.[2] Using data from COMPUSTAT, I compared all respondents to nonrespondents on company size measured as both assets in millions and number of full-time employees, ROS, and return on assets (ROA); the t-test revealed no significant differences. These results indicated that respondents did not vary significantly from the *Fortune* 500 population. Responding companies averaged 23,093 (s.d. = 15,662) full-time employees and $4,329.2 (s.d. = 2,334.7) million in assets.

The survey targeted the firms' CEOs or most senior executives because of their likely familiarity with company-wide strategic actions, especially corporate entrepreneurship efforts (Miller, 1983; Zahra, 1991). Analysis of the titles of respondents showed that 79 percent were CEOs or presidents, 17 percent were senior vice presidents, and the remaining 4 percent were board secretaries. These figures suggested that the survey data were provided by the firms' senior executives.

Interrater reliability. The questionnaire was also sent to a second randomly selected group of executives in the responding companies (n = 138). One mailing yielded 49 completed responses (35.5 percent) that I then matched with replies from the CEOs. The correlation between the two responses was significant ($p < .001$), which indicated strong interrater reliability (Jones, Johnson, Butler, & Main, 1983).

Measures

Ownership and governance. Four variables, averaged over the 1988–90 period, were constructed as follows: *Outsider ratio* was measured by dividing the number of outside directors by the total number of directors on a board. Data were obtained from the 1991 *Corporate* 1000. Following previous research (e.g., Cochran et al., 1985; Gilson, 1990), I considered directors outsiders when they were not former employees (officers) of a firm or its subsidiaries (divisions), did not possess contractual relationships with it, or were not associated with a major supplier to the company. *Outsider equity ownership* was defined as the sum of outsiders' equity divided by a company's common shares. Data came from *Value Line*. *Executive ownership* was measured by the percentage of a company's total stock held by its senior executives, defined as vice presidents and those in higher offices (Chaganti & Damanpour, 1991). Data were obtained from *Standard & Poor's Stock Reports* and were available for only 127 companies. To measure *institutional ownership,* I identified two groups of institutional investors. The first, long-term institutional investors, included mutual, pension, and retirement funds. The second, short-term institutional owners, covered investment bankers and private funds. Both variables were measured as the percentage of a company's stock held by the focal group, calculated by using data from

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[2] The two items were "This company has reduced its support of new business ventures in markets outside the US," and "This company has encouraged risk taking by managers in its overseas subsidiaries."

Standard and Poor's Stock Reports.

Corporate entrepreneurship. The variable was measured using the survey data. Innovation, venturing, and strategic renewal were addressed in 14 items. Executives rated their firms' actual, rather than preferred, entrepreneurial activities using a five-point scale (1 = strongly disagree, 5 = strongly agree). I then factor-analyzed the items using varimax rotation. As Table 1 shows, three factors with eigenvalues exceeding 1.0 resulted and, combined, explained 57.02 percent of the variance.

The first factor (five items, $\alpha = .76$) captured a company's commitment to *innovation.* Items covered the creation and introduction of products, emphasis on R&D investments, and commitment to patenting. Items also corresponded to previously used measures of organizational aggressiveness and proactiveness (Lumpkin & Dess, 1996; Miller, 1983), radical product innovation, strong R&D, and patenting (Hitt et al., 1991; Zahra, 1995). The second factor (five items, $\alpha = .70$) captured a firm's *venturing* activities, such as

TABLE 1
Results of Factor Analysis of the Corporate Entrepreneurship Measures

	Factors[a]		
Items	**1**	**2**	**3**
Over the past three years, this company. . .			
Has spent heavily (well above your industry average) on research and development (R&D).	**.83**	−.25	.17
Has maintained world-class research and development (R&D) facilities.	**.79**	−.28	.19
Has introduced a large number of new products to the market.	**.71**	.21	−.27
Has acquired significantly more patents than its major competitors.	**.67**	.28	−.21
Has pioneered the development of breakthrough innovations in its industry.	**.53**	−.18	−.16
Has entered many new industries.	.29	**.70**	−.21
Has expanded its international operations significantly.	.25	**.66**	−.13
Has acquired many companies in very different industries.	−.26	**.63**	.17
Has established or sponsored several new ventures.	.23	**.60**	−.14
Has focused on improving the performance of its current business, rather than entering new industries.[b]	.17	**−.53**	.26
Has divested several unprofitable business units.	−.26	−.17	**.69**
Has changed its competitive approach (strategy) for each business units.	.25	.11	**.62**
Has initiated several programs to improve the productivity of business units.	.27	−.19	**−.57**
Has reorganized operations to ensure increased coordination and communication among business units.	.25	−.15	**.54**
Eigenvalve	3.11	2.36	1.88
Percentage of variance explained	24.13	18.31	14.58

[a] Loadings with an absolute value of .50 were considered significant.

[b] Reversed-coded.

entry into new business fields by sponsoring new ventures (Block & MacMillan, 1993) and creating new businesses (Zahra, 1991, 1993). The third factor (four items, $\alpha = .73$) covered *strategic renewal* efforts aimed at revitalizing a company's ability to compete (Sathe, 1989; Stopford & Baden-Fuller, 1994) and redefining its business domain by eliminating unprofitable operations while improving internal efficiencies (Hoskisson & Hitt, 1994).

Three steps were used to establish the validity of the corporate entrepreneurship measures. First, I used Miller's (1983) corporate entrepreneurship index ($\alpha = .71$). The items, presented in the Appendix, followed a five-point Likert scale (5 = strongly agree, 1 = strongly disagree). Miller's index was associated ($p < .001$) with innovation ($r = .81$), venturing ($r = .57$), and renewal ($r = .66$). Second, I developed an objective indicator using the three-year averages of a firm's R&D spending as a percentage of sales, the number of products it introduced to the market, and the percentage of its revenue from businesses that did not exist three years earlier. A factor analysis with a varimax rotation produced one significant factor that I labeled "objective CE" (eigenvalue = 1.37). The factor score was then significantly correlated with innovation, venturing, and renewal (all at $p < .001$). Finally, interrater reliability between two executives was significant on the three corporate entrepreneurship measures (all at $p < .001$).

Technological opportunities. To gauge this variable, respondents were asked to focus on their firm's major industry over the three-year period before data collection. Perceptions of this industry usually determine managerial actions (Keats & Hitt, 1988). A four-item index based on the survey was used ($\alpha = .71$); survey items appear in the Appendix.

Control variables. The study also included six control variables that were believed to influence corporate entrepreneurship. The average figure for the 1988–90 period was used for each variable, as follows: *CEO duality* meant that a company's CEO also served as its board's chairperson (Finkelstein & D'Aveni, 1994). Because CEO duality can reduce the ability of outsiders to evaluate corporate entrepreneurship, it was entered as a dummy variable coded 1 if the CEO also served as the chair and 0 otherwise. The *debt-to-common-equity ratio* was also considered because heavily leveraged companies have limited slack resources, which, in turn, reduces corporate entrepreneurship (Hansen & Hill, 1991). Data were collected from COMPUSTAT. *Liquidity* was considered because corporate entrepreneurship requires slack resources. I entered the current ratio, which indicated the availability of these funds, as a control variable and calculated it using data from COMPUSTAT. *Company size* was included in the analysis because I expected a negative association between size and corporate entrepreneurship. It was measured as the logarithm of corporate assets, using data from the *Fortune* 500. *Past performance* was also considered because, when a company performs well, slack resources increase, which encourages entrepreneurial activity. I collected data from *Business Week,* COMPUSTAT, and *Fortune* on ROA, a major indicator of profitability, and calculated a three-year average. Also, because industries varied in their performance, I adjusted past performance data by subtracting a firm's major industry's performance from the firm's rating for the same period. I also controlled for *industry type*. Following Hitt and Ireland (1985), I classified the major industry of a firm (listed in the *Fortune* 500) as consumer nondurable (n = 40), consumer durable (n = 31), producer goods (n = 29), and capital goods (n = 27). Dummy codes were then assigned.

ANALYSIS AND RESULTS

Table 2 presents the means, standard deviations, and correlations among the study's variables. The means for outsider ratio and outsider ownership, executive ownership, total institutional ownership, debt-to-equity ratio, liquidity, and CEO duality are consistent with past research.

Hierarchical regression analysis was used to test the study's hypotheses. I entered the control variables first (step 1), then the independent variables (step 2), then the interaction terms (step 3). One interaction term was the cross product of the ratio of outsiders on a board and outsider stock ownership. The remaining interaction terms were formed using the cross products of technological opportunities and the study's independent variables, as reported in Table 3.

As Hypothesis 1 predicts, the outsider ratio was negatively associated with the three corporate entrepreneurship measures, all at $p < .05$. The results for Hypothesis 2 also showed that although outsider ownership had positive coefficients in the three regression equations, only the beta for venturing was significant ($p < .05$). Also, the coefficients for the interaction of outsider ratio and ownership were negative and insignificant in the three equations. The betas for the interaction terms were smaller than, but not significantly different from, those derived from the outsider ratio only; this finding supported Hypothesis 2.

The data in Table 3 also supported Hypothesis 3, as executive ownership was positively associated with the three corporate entrepreneurship measures (all at $p < .05$). Further, consistent with Hypothesis 4a, long-term institutional investment was positively and significantly associated with innovation ($p < .01$) and venturing ($p < .05$), but not with strategic renewal. Similarly, although short-term institutional investment was negatively associated with innovation ($p < .05$) and venturing ($p < .01$), it was not significantly associated with strategic renewal. These results partially supported Hypothesis 4b.

The results also supported Hypothesis 5. As Table 3 shows, the interaction of technological opportunities with the outsider ratio was significant in the three regression equations ($p < .01$), as was opportunities' interaction with outsider ownership ($p < .05$). The three-way interaction term crossing outsider ratio, outsider ownership, and technological opportunities was negative and insignificant in the three regressions. The interactions of technological opportunities with both executive ownership and long-term institutional ownership were positive and significant in the three equations. The interaction of technological opportunities with short-term institutional own-

TABLE 2
Descriptive Statistics and Correlations[a]

Variables	Mean	s.d.	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Innovation	3.17	1.29													
2. Venturing	2.94	1.47	−.31												
3. Strategic renewal	2.87	1.73	.27	.29											
4. Outsider ratio	0.62	0.25	−.21	−.18	−.20										
5. Outsider ownership	0.03	0.04	.04	.06	.26	.26									
6. Executive ownership	7.13	11.58	.29	.25	.36	−.30	.11								
7. Long-term institutional ownership	15.11	10.89	.27	.22	.05	.31	.14	.16							
8. Short-term institutional ownership	20.83	17.61	−.29	−.33	.09	.21	.09	−.22	.29						
9. Debt-to-equity ratio	0.49	0.46	−.28	.19	−.23	.35	.23	.09	−.09	−.13					
10. Liquidity	2.13	0.66	.18	.19	.21	.03	−.05	.07	.05	.05	.09				
11. CEO duality	0.73	0.29	.11	.09	.14	−.16	.03	.13	−.19	−.21	.06	.09			
12. Perceived technological opportunities	3.01	1.21	.21	−.34	.19	.31	.14	.29	.19	.24	−.13	.13	.06		
13. Company size	6.07	9.14	.10	.15	−.12	.24	.29	−.34	.07	.14	.37	−.20	−.10	−.13	
14. Past ROA	7.91	5.12	.19	.23	.26	.10	.19	.14	.18	.23	−.21	.08	−.03	.29	.26

[a] Correlations greater than or equal to .18 are significant ($p < .05$); $n = 127$.

TABLE 3
Results of Hierarchical Regression Analysis[a]

		Innovation				Venturing				Renewal			
Step	Variables	β	R^2	ΔR^2	F	β	R^2	ΔR^2	F	β	R^2	ΔR^2	F
1	Control												
	Liquidity	.18*				.21*				.23*			
	Debt-to-equity ratio	–.11				–.23*				–.22*			
	CEO duality	.13				.15				.09			
	Company size	.08				.12				.13			
	Past ROA	.23*				.21*				.25*			
	Consumer nondurable	.19*				.10				.21*			
	Consumer durable	.07				.16				.07			
	Capital goods	–.11	.16		4.21**	.13				.15	.15		2.91*
2	Independent												
	Outsider ratio	–.25*				–.19*				–.27*			
	Outsider ownership	.11				.23*				.09			
	Executive ownership	.29*				.20*				.24*			
	Long-term institutional	.31**				.26*				.12			
	Short-term institutional	–.19*	.39	.23	9.53***	–.31**	.38	.17	13.81***	.09	.29	.14	6.01**
3	Interaction terms												
	Outsider ratio × outsider ownership	–.13				–.07				–.03			
	Outsider ratio × perceived technological opportunities	–.39***				–.30**				–.37**			
	Outsider ownership × perceived technological opportunities	.19*				.29*				.19*			
	Outsider ratio × outsider ownership × perceived technological opportunities	–.02				–.03				–.02			
	Executive ownership × perceived technological opportunities	.43***				.31**				.41**			
	Long-term institutional ownership × perceived technological opportunities	.39***				.33**				.21*			
	Short-term institutional ownership × perceived technological opportunities	–.37***	.49	.10	14.37***	–.41**				.29*	.42	.13	10.73***

$^*p < .05$; $^{**}p < .01$; $^{***}p < .001$.

ership had a negative and significant association with both innovation ($p <$ .01) and venturing ($p < .01$); however, its relationship with renewal was positive and significant.

Table 3 shows that of the control variables, liquidity and past ROA had positive and significant associations with corporate entrepreneurship. The debt-to-equity ratio was negatively and significantly associated with venturing and renewal and had a negative but insignificant association with innovation. CEO duality and company size were insignificant in the three regression equations. Finally, only the consumer nondurable group had positive associations with both innovation and renewal.

DISCUSSION

Review of Findings

The results of this study support the importance of corporate governance and ownership variables for explaining commitment to corporate entrepreneurship among the largest U.S. industrial corporations, the *Fortune* 500. Consistent with Hypothesis 1, the results show an inverse but significant association between the proportion of outside directors on a board and corporate entrepreneurship. These results support Baysinger and Hoskisson's (1990) suggestion that inside directors may be better positioned than outsiders to judiciously evaluate entrepreneurial activity. The results also support the conclusions of other researchers (e.g., Baysinger & Butler, 1985; Hill & Snell, 1988; Porter, 1992) who have noted that a high ratio of outsiders on a company's board may have unintended costs, such as low corporate entrepreneurship. One reason is the tendency of some outside directors to engage in free riding and to use financial (not strategic) controls. The results also raise a question about the merits of staffing boards primarily with outside directors, especially in view of the findings relating to Hypothesis 2.

The finding that ownership by outside directors may temper the negative association between outsider's representation and corporate entrepreneurship is consistent with Hypothesis 2. Outside directors' ownership may align their interests with those of other shareholders, encourage monitoring of managerial actions, and increase directors' interest in corporate entrepreneurship. As outside directors' ownership may mitigate the negative association of a high proportion of outsiders with corporate entrepreneurship, companies should consider providing incentives through stock ownership to outside directors. There are upper limits, however, to the potential impact of such stock ownership on the association between outsider representation on a board and corporate entrepreneurship, as evidenced by the negative signs of the interaction term in the three regression equations.

Another concern about outside directors' increased stock ownership is that it promotes control over these directors by a firm's CEO and other senior executives. In fact, following the publication of Cadbury's (1992) report, the United Kingdom prohibited outside directors from holding strong equity positions in their firms. This step was deemed necessary to reduce the prospect of CEOs controlling their boards. This problem is not currently serious in the United States, but if companies increase their use of stock ownership as a means of motivating outside directors, the independence and objectivity of these directors might be compromised.

Besides the declining value as a motivator of incentives through stock ownership, the lack of access to information on corporate entrepreneurship may continue to frustrate even those outside directors who own relatively large blocks of corporate stock. This difficulty may induce some outside directors to encourage managers to pursue a different form of entrepreneurial activity, one that centers on new market entry through venturing rather than on patient new product innovation. Thus, ownership by outsiders may promote acquisition activities rather than internal business and product development, the traditional focus of corporate entrepreneurship activities. Although the extent and implications of such a shift for company performance have not been fully studied, Hoskisson, Johnson, and Moesel (1994) suggested that outside ownership increased debt, which is usually associated with a high number of mergers, acquisitions, and restructurings. Clearly, if long-term pursuit of corporate entrepreneurship is sought, there is a need to reexamine the wisdom of using outside directors and offering them incentives in the form of stock ownership.

Consistent with Hypothesis 3, stock ownership by executives is positively associated with corporate entrepreneurship, which may reflect a closer alignment between the goals of executives and shareholders. Although the results support Jones and Butler's (1992) position, they contradict the insignificant associations between executive ownership and R&D spending Hill and Snell (1988, 1989) found. Perhaps executive ownership is more relevant in the case of corporate entrepreneurship, where managers may have great discretion in the decision-making process. By contrast, R&D allocations are usually monitored by the financial community, which may limit executives' willingness to reduce these investments.

Mixed support emerged for Hypotheses 4a and 4b. Long-term institutional ownership was positively and significantly associated with both innovation and venturing, but the coefficient for strategic renewal was positive and insignificant. Perhaps long-term institutional owners readily appreciate the need to use patient capital to redefine a company's business through innovation and venturing. Concurrently, these investors may view strategic renewal efforts as stopgap measures that do not improve a company's capacity to create long-term value.

A different pattern was observed for short-term institutional ownership, for which strategic renewal had a positive and insignificant beta, while both innovation and venturing had negative and significant betas. These results are consistent with those of Graves (1988), who found a negative association between institutional stock ownership and R&D investments. The present results also support the concerns expressed over the potential impact of short-term institutional investors on innovation and new business creation activities (National Academy of Engineering, 1992). Short-term investors may discourage innovation and venturing because these activities take a long time to pay off.

Combined, the results on Hypotheses 4a and 4b highlight the importance of separating the different types of institutional owners in order to better understand their associations with corporate entrepreneurship. Researchers should further explore the conditions under which investors are willing to exercise their powers and voice their displeasure with managers' inattention to entrepreneurship. By considering the size of institutional holdings, investment time horizons, and disposition to exercise their powers, researchers can identify the conditions under which institutional owners influence corporate entrepreneurship positively and negatively.

A key finding from this study is that perceived technological opportunities may significantly moderate the associations of corporate governance and ownership systems with corporate entrepreneurship. The results support Hypothesis 5 and show that two variables are positively and significantly associated with corporate entrepreneurship in industries with high technological opportunities: high levels of executive ownership and long-term institutional ownership. However, short-term institutional investors and a high proportion outsiders of board have negative and significant associations with entrepreneurial activity. These results indicate that some governance and ownership systems may inhibit corporate entrepreneurship more in industries with high technological opportunities. As predicted by the National Academy of Engineering (1992), transient capital may reduce the innovation and venturing components of corporate entrepreneurship. The same is also true for the increased representation of outside directors on a company's board, even when they have an ownership stake in the company. Finally, the significant, positive coefficient of the three-way interaction of short-term stitutional ownership, technological opportunity, and renewal indicates that short-term institutional investors may be more relevant for strategic renewal in stable environments. Overall, the results for Hypothesis 5 indicate a need to explicitly consider the influence of a firm's competitive setting on the design of its governance system and corporate entrepreneurship.

Managerial and scholarly implications. The results show that executive ownership of a company's stock is positively associated with corporate entrepreneurship. Thus, executives' incentives appear to make a significant difference in creating commitment to entrepreneurial activity. By providing incentives to managers in the form of increased stock ownership, boards can turn managers into owners and increase their support of such activity. To achieve this transformation, a portion of managers' compensation can be given in stock ownership.

Companies also need to reconsider their approach to improving board performance. They need to examine both the composition of a board and the incentives they offer outside directors. Incentives like stock ownership may somewhat mitigate the negative association between a high proportion of outside directors and corporate entrepreneurship. In particular, companies need to explore ways to enhance the motivation of their directors and foster their commitment to such activity. Rather than simply increasing the representation of particular groups of directors on a board, companies should explore other ways to encourage directors' attention to corporate entrepreneurship.

Although the growing power of institutional owners has been a source of concern among executives and public policy makers, the present results offer some hopeful news. Long-term institutional ownership is positively associated with both the innovation and venturing aspects of corporate entrepreneurship. Perhaps executives should work more closely with these investors to explain different initiatives and their potential contributions to value creation. Increased communication with institutional owners might also counter the negative association of short-term institutional investors with corporate entrepreneurship, a major source of concern in industries with high technological opportunities.

Replications with data from companies in other sectors of the U.S. economy are needed to establish the robustness of the present findings. This research would confirm whether governance and ownership systems impede corporate entrepreneurship more in industries with high technological opportunities. Researchers should consider conducting comparative studies of companies in high- and low-technology industries. If the current associations are corroborated, then future efforts directed as reforming corporate boards can be better guided by research findings.

Another area for future research is outside directors' supposed reliance on financial, rather than strategic, controls in evaluating corporate entrepreneurship. This proposition should be verified empirically, using explicit measures of different types of controls. Currently, the bulk of the literature on this issue is speculative and anecdotal.

Researchers should also identify different groups of institutional owners and determine their effect on the different dimensions of corporate entrepreneurship. For example, researchers can classify institutional investors in terms of their long-term staying power, defined as their ability to withstand the pressures resulting from stock market performance (Kochhar & David, 1996) and then examine the commitment of these investor groups to corporate entrepreneurship. Researchers should also distinguish activist from nonactivist institutional investors (Roe, 1994) and document differences between the two regarding corporate entrepreneurship. Understanding the motives and tactics of activist institutional investors should yield a richer appreciation of their effect on entrepreneurial activity. A model that identifies the conditions leading to activism and managerial responses to it would also advance scholarship in this area.

Today, corporate entrepreneurship is essential for ensuring corporate profitability and growth by enhancing a company's innovation, redefining its business concept, and renewing its operations. Nurturing entrepreneurial activities in established companies, however, requires interested management, patient capital, and enlightened investment policies. This study shows that corporate governance and ownership systems can affect corporate entrepreneurship efforts significantly, and this impact varies considerably between industries with low and high technological opportunities.

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APPENDIX

Corporate Entrepreneurship

As reported in the text and in Table 1, 14 items were used to measure corporate entrepreneurship and factor analysis yielded three factors. Three approaches were then used to validate these measures.

1. An overall index was developed by summing scores on these items and then dividing the total by 7 ($\alpha = .71$). This index, developed by Miller (1983), consisted of the following items: "Our company has introduced many new products or services over the past three years," "Our company has made many dramatic changes in the mix of its products and services over the past three years," "Our company has emphasized making major innovations in its products and services over the past three years," "Over the past three years, this company has shown a strong proclivity for high-risk projects (with chances of very high return)," "This company has emphasized taking bold, wide-ranging action in positioning itself and its products (services) over the past three years," "This company has shown a strong commitment to research and development (R&D), technological leadership, and innovation," and "This company has followed strategies that allow it to exploit opportunities in its external environment."

2. An objective corporate entrepreneurship indicator was constructed using the three-year average on three variables, as follows: (a) *R&D spending as a percentage of sales.* Data were collected from the 1988–90 volumes of the *Business Week Corporate R&D Scoreboard.* Because of the uncertain payoff associated with these activities, R&D spending is a widely used measure of corporate innovation and risk taking (Hoskisson et al., 1993). (b) *Number of new products introduced to market.* Like R&D, product innovation involves considerable risks, nearly 80 percent of all new products fail upon market introduction. New products enhance a company's ability to serve current and new customers or penetrate new markets, thus fueling both growth and profitability. New products are a major indicator of corporate entrepreneurship (Zahra, 1993). CEOs were asked to indicate "the total number of new and modified products your company introduced to the market over the past three years." I then collected three years of data for 41 companies (about 30 percent of the sample) from annual reports and trade publications. Survey and archival data were significantly correlated ($r = .72$, $p < .001$). (c) *Percentage of revenues from businesses that did not exist three years earlier.* Executives provided data on the percentage of revenues generated by divisions or strategic business units created within the last three years. This measure captures a firm's involvement in creating new business and venturing activities (Block & MacMillan, 1993; Zahra, 1993). Data were available for 113 companies. To validate the survey measure, I collected data for 37 companies (32.7 percent of the responding companies) from annual reports and COMPUSTAT. The two sources were significantly correlated ($r = .74$, $p < .01$).

3. I also examined the interrater reliability of the three corporate entrepreneurship factors using data from two executives, as reported in the text.

Technological Opportunities

This index consisted of the following items: "Opportunities for product innovation are abundant in our major industry," "Opportunities for technological innovation are abundant in our major industry," "Spending on research and development (R&D) is higher in our major industry than in most industries," and "Opportunities for major technological breakthroughs are abundant in our major industry." The average score on these items was entered into the regression analyses. The items followed a five-point response format (5 = strongly agree, 1 = strongly disagree).

To ensure valid results, I also conducted the analysis using a firm's major industry's past three-year average R&D spending. The results were similar to those found when the survey-based index was used. Hence, only the results from the overall technological opportunities index are reported.

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ACADEMY OF MANAGEMENT CODE OF ETHICAL CONDUCT

CREDO

We believe in discovering, sharing, and applying managerial knowledge.

PREAMBLE

Our professional goals are to enhance the learning of students, colleagues, and others and to improve the effectiveness of organizations through our teaching, research, and practice of management. We have five major responsibilities:

1. To our students—Relationships with students require respect, fairness, and caring, along with recognition of our commitment to the subject matter and to teaching excellence.
2. To managerial knowledge—Prudence in research design, human subject use, confidentiality, result reporting, and proper attribution of work is a necessity.
3. To the Academy of Management and the larger professional environment—Support of the Academy's mission and objectives, service to the Academy and our institutions, and the recognition of the dignity and personal worth of colleagues is required.
4. To both managers and the practice of management—Exchange of ideas and information between the academic and organizational communities is essential.
5. To all people with whom we live and work in the world community—Sensitivity to other people, to diverse cultures, to the needs of the poor and disadvantaged, to ethical issues, and to newly emerging ethical dilemmas is required.

STUDENT RELATIONSHIPS

In our roles as educators, the central principles that underlie appropriate student-educator relationships are professionalism, respect, fairness, and concern.

Striving for teaching excellence. It is the duty of Academy members who are educators to prepare themselves carefully. Maintenance of current knowledge in the field requires a broad understanding of management theories, research and practice, and use of current classroom materials. Educators should have or develop expertise in the areas in which they teach. Effective teaching requires sufficient time allocated to preparation, clear classroom communication, timely grading, and a willingness to provide an explanation of a student's grade. Educators should act as role models in their relationships. They should also sensitize students to the ethical dimensions of management. In addition, educators have an obligation to present material without conscious bias and to make their own relevant biases known to their students. Educators should attempt to evaluate their teaching through some appropriate outcome assessment method which goes beyond concept retention.

Showing respect for students. It is the duty of Academy members who are educators to show appropriate respect for students' feelings, interests, needs, contributions, and intellectual freedom. Students' right to privacy requires maintaining the confidentiality of academic records and private communications, unless disclosure is mandated by law, institutional policy, or morally compelling purpose. Educators must avoid manipulation, coercion, or exploitation of students (especially acts directed at securing monetary, ego, or sexual gratification) and should demonstrate a sensitivity to cultural and personal diversity by avoiding racial, sexual, religious, and ethnic discrimination.

Maintenance of objectivity and fairness. It is the duty of Academy members who are educators to treat students equitably. Fair treatment of students requires explicitly explaining and adhering to academic requirements and standards. Any subsequent change in these requirements or standards, either of the institution or in an individual course, should appropriately recognize the impact on students. Impartiality, objectivity, and fairness are required in all dealings with students. Examinations should be carefully prepared and written work graded in an impartial manner. Educators should scrupulously avoid entering any overly personal relationship or accepting any gift or favor which might influence, or appear to influence, an objective evaluation of a student's work. Appropriate evaluation of student performance requires test design, assignments, and testing conditions which minimize the possibility of academic misconduct. It is the educator's responsibility to pursue appropriate disciplinary action if necessary.

Counseling of students. It is the duty of Academy members to be helpful and sensitive in counseling students. When serving as academic advisors, members must be knowledgeable about academic requirements and should communicate these clearly and fully to advisees. Educators may play critical roles in a variety of counseling situations. This requires careful analysis of the student and situation and calls for special expertise and competence. Counseling advice should be identified as an expression of the member's own opinion. Letters of recommendation require candor and fairness. Members should not make insupportable statements nor fail to disclose material facts.

ADVANCEMENT OF MANAGERIAL KNOWLEDGE

Research of Academy members should be done honestly, have a clear purpose, show respect for the rights of all individuals and organizations, efficiently use resources, and advance knowledge in the field.

Conducting and reporting. It is the duty of Academy members conducting research to design, implement, analyze, report, and present their findings rigorously. Research rigor includes careful design, execution, analysis, interpretation of results, and retention of data. Presentation of research should include a treatment of the data that is honest and that reveals both strengths and weaknesses of findings. When important alternate hypotheses or explanations exist, they should be noted and data that disconfirm hypotheses should be acknowledged. Authorship and credit should be shared in correct proportion to the various parties' contributions. Whether published or not, ideas or concepts derived from others should be acknowledged, as should advice and assistance received. Many management-related journals have policies prohibiting or restricting potential articles from being reviewed concurrently in other outlets. These policies should be closely observed or there should be explicit discussion with the relevant journal editors concerning the intended multiple submissions. More than one report of essentially the same data and results should not be published unless the reports are explicitly directed to different audiences through different types of outlets. When several separate but related reports result from a single study, the existence of the different reports should be made known to the relevant journal editors and the reports should reference each other. Reviewer comments should be considered thoughtfully before a manuscript is submitted to a different journal.

Participants. It is the duty of Academy members to preserve and protect the privacy, dignity, well-being, and freedom of research participants. This duty requires both careful research design and informed consent from all participants. Risks and the possibility of harm to research participants must be carefully considered and, to the extent possible, these must be minimized. When there is a degree of risk or potential harm inherent in the research, potential participants—organizations as well as individuals—must be informed. Informed consent means explaining to potential participants the purposes and nature of the research so they can freely choose whether or not to become involved. Such explanations include warning of possible harm and providing explicit opportunities to refuse to participate and to terminate participation at any time. Because students and employees are particularly subject to possible coercion, even when unintended, special care must be taken in obtaining their informed consent. Third-party review is one means of protecting the interests of research participants. Research plans involving human participants should be reviewed by an appropriate third party, such as a university human subjects committee or a focus group of potential participants. Questions regarding confidentiality or anonymity must be resolved between researcher and potential research participants, both individuals and organizations; if confidentiality or anonymity is requested, this must be honored. Deception should be minimized and, when necessary, the degree and effects must be mitigated as much as possible. Researchers should carefully weigh the gains achieved against the cost in human dignity. To the extent that concealment or deception is necessary, the researcher must provide a full and accurate explanation to participants at the conclusion of the study, including counseling, if appropriate.

Dissemination. It is the duty of journal editors and reviewers to exercise their position of privilege in a confidential, unbiased, prompt, constructive, and sensitive manner. They have a duty to judge manuscripts only on their scholarly merits. Conflicts of interest may arise when a reviewer is in basic disagreement with the research approach or the line of research represented by a manuscript. In such cases, a reviewer should consult with the journal editor to decide whether to accept or decline to review the manuscript. Protecting intellectual property is a responsibility of the reviewer and the editor. The content of a manuscript is the property of its authors. It is therefore inappropriate to use ideas or show another person a manuscript one has been asked to review, without the explicit permission of its authors. Advice regarding specific, limited aspects of the manuscript may be sought from qualified colleagues so long as the author's intellectual property remains secure. Sharing of reviewing responsibilities is inappropriate. The review is the sole responsibility of the person to whom it was assigned by the journal editor. In particular, students and colleagues should not be asked to prepare reviews unless the journal's editor has given explicit approval. Anyone contributing to a review should receive formal recognition. Constructive review means providing critiques and comments in a spirit of collegiality with thoroughness, timeliness, compassion, and respect, and in ways intended to improve the quality of the manuscript.

Grants and contracts. It is the duty of Academy members to accurately represent themselves and their proposed projects and to manage those projects as promised. Representation means accurate disclosure of one's level of expertise and expected actual involvement, the outcomes that can be reasonably expected, the realistic funding level needed, and potential conflicts of interest. Grant and contract management requires independence and objectivity such that one does not compromise one's responsibilities or create conflicts of interest. One must also manage time and budget responsibly and use the funds as promised unless permission is explicitly granted to do otherwise.

THE ACADEMY OF MANAGEMENT AND THE LARGER PROFESSIONAL ENVIRONMENT

The Mission Statement of the Academy describes member benefits and professional opportunities of members which impose corresponding duties and service responsibilities.

Sharing and dissemination of information. To encourage meaningful exchange, Academy members should foster a climate of free interchange and constructive criticism within the Academy and be willing to share research findings and insights fully with other members.

Academy participation. The Academy is a voluntary association whose existence and operations are dependent on cooperation, involvement, and leadership from its members. Members should abide by the constitution, by laws, policies, and codes of the Academy. Members should consider offering their time and talent to carry out activities necessary to maintain the Academy and its functions. Officers and members should fulfill their Academy obligations and responsibilities in a timely, diligent, and sensitive manner, without regard to friendships or personal gain. Members should honor all professional commitments, including presentation of accepted papers and participation in scheduled roles as chair, discussant, or panel member. If absence from a scheduled meeting is unavoidable, members must contact appropriate individuals and pursue suitable alternative arrangements. One should consider the impact one's projects or activities may have on the integrity or reputation of the Academy and one should not engage in such projects or activities that may have possible negative implications. Members should not imply that their work is sanctioned by the Academy unless an appropriate Academy body has specifically done so.

Commitment to professional standards of conduct. By this code, the Academy provides ongoing ethical guidance for its members. Members should work to raise the consciousness of other members concerning ethical responsibilities, and they should encourage acceptance of these responsibilities. Members should notify appropriate Academy officers or committees regarding the practices or actions of members they believe may violate Academy regulations or general standards of ethical conduct. In this manner, the aspirational and educational goals of this code are served through discussion of the ethical dilemmas and values of our profession.

Strengthening and renewal of the Academy. The Academy of Management must have continuous infusions of members and new points of view to remain viable and relevant as a professional association. Members may contribute by encouraging all eligible individuals to participate in the Academy and by assisting new and prospective members in developing their skills, knowledge, and understanding of their professional obligations.

The professional environment for many Academy members includes the university community. The central values which underlie appropriate university participation are understanding, involvement, respect, fairness, and the pursuit of knowledge.

Participation in university leadership. Professors should take an active interest in university governance. Professors should be aware of university policies that affect the dissemination of policies. Professors should endeavor to positively influence policies relating to the quality of education and service to students. Active organizational involvement requires exercise of personal voting rights and respect for such rights of others, without regard to rank or tenure. Professors should evaluate colleagues for purposes of promotion or tenure on the basis of appropriate academic criteria that is fairly weighted in accordance with standards understood by the faculty and the subject of evaluation. It is the duty of Academy members to treat their colleagues with respect and fairness. Members should safeguard confidential personal matters and avoid disclosing opinions expressed, attribution of statements, voting behavior, and outcomes. Members should address misunderstandings and conflicts with those directly involved and avoid speculative criticism that might damage the reputations of individuals or groups. When speaking or acting outside their university roles, professors should avoid creating the impression that they are speaking or acting for their university or its administration. Professors should dispose of complimentary books requested from publishers by a manner other than sale.

All Academy members, whether affiliated with a university, business, governmental, service, or consulting organization have an obligation to interact with others in a professional manner.

Membership in the professional community. It is the duty of Academy members to interact with others in our community in a manner that recognizes individual dignity and merit. The responsible professional promotes and protects the rights of individuals without regard to race, color, religion, national origin, handicap, sex, sexual orientation, age, political beliefs, or academic ideology, and refrains from sexual harassment. In the spirit of intellectual inquiry, the professional should welcome suggestions and complaints openly without reprisal. Members should ensure that outside activities do not significantly diminish their availability and energy to meet their institutional obligations.

MANAGERS AND THE PRACTICE OF MANAGEMENT

Consulting with client organizations ("clients") has the potential for enriching the teaching and practice of management, for translating theory into practice, and for furthering research and community service. To maximize such potential benefits, it is essential that members who consult be guided by the ideals of competence, integrity, and objectivity.

Credentials and capabilities. It is the duty of consultants to represent their credentials and capabilities in an accurate and objective manner. Consultants shall accept only those assignments for which they have appropriate expertise. Consultants shall refrain from exaggerating their professional qualifications to secure prospective assignments. Consultants shall examine any factors (e.g., prior experience, capabilities, other commitments) that might limit their judgment or objectivity in carrying out an assignment. University endorsement of the consulting activities of Academy members should not be represented or implied to potential clients unless the assignment is formally under university sponsorship or is so approved.

Obligations to clients. Consultants have a duty to fulfill their obligations to their present and prospective clients in a professionally responsible and timely manner. Consultants shall place the highest possible priority on their clients' interests. Consultants shall avoid or withdraw from situations in which their clients' interests come into serious conflict with their own. Consultants shall not serve two or more competing clients without the consent of all parties. Consultants shall fully inform their clients. This means presenting results or advice in an unbiased manner, and discussing fully with the client the values, risks, and limitations of the recommendations.

Client relations. Consultants must fulfill duties of confidentiality and efficiency as part of the relationship with their clients. Consultants shall maintain confidentiality with respect to their clients' identities and the assignments undertaken unless granted permission by the client. Consultants should exercise concern for the protection of clients employees and other stakeholders by maintaining, in particular, appropriate confidentiality. Consultants shall not take personal or financial advantage of confidential information acquired as a result of their professional relationships, nor shall they provide the basis upon which others may take such advantage. Consultants should meet their time commitments and conserve the resources utilized.

Remuneration. It is the duty of consultants to negotiate clear and mutually accepted remuneration agreements for their services. Consultants shall provide a realistic estimate of the fees to be charged in advance of assignments. Fees charged shall be commensurate with the services performed.

Societal responsibilities. Consultants have a duty to uphold the legal and moral obligations of the society in which they function. Consultants should report to the appropriate authorities any unlawful activities that may have been uncovered during the course of engagements except where their functional professional code directs otherwise.

Students and employees. It is the duty of the consultant to safeguard student and employee rights when they are involved in consulting assignments. Consultants may involve students in work generated by engagements, especially is such work possesses learning potential, but students must not be coerced into participation. When they are so involved, students, as well as employees, should be fairly compensated and be made aware of the nature of the work they are doing.

THE WORLD COMMUNITY

As citizens of the world community, Academy members may have much to contribute in shaping global consciousness by their teaching, research, and service.

World view. Academy members have a duty to consider their responsibilities to the world community. In their role as educators, members of the Academy can play a vital role in encouraging a broader horizon for decision making by viewing issues from a multiplicity of perspectives, including the perspectives of those who are least advantaged. As researchers, members of the Academy should consider, where appropriate, increasing their exposure to other cultures via travel, study, and research. Where appropriate, the research might highlight the responsible stewardship of the Earth's resources. In addition, members should take as a challenge the ongoing task of identifying evolving ethical issues by listening to those whose welfare is affected and by exploring the interaction of people and technology. In fulfilling their service responsibilities, members of the Academy should consider how they might lend their time and talent to enhance the world community through involvement in uncompensated public service.

SEXUAL HARASSMENT

The Academy of Management and its members are committed to providing academic environments that are free of sexual harassment and all forms of sexual intimidation and exploitation.

Sexual harassment consists of unwelcome sexual advances, requests for sexual favors, and other visual, verbal, or physical conduct of a sexual nature when:

1. It is implicitly or explicitly suggested that submission to or rejection of the conduct will be a factor in academic employment, admission, evaluation, or participation in an academic activity.
2. The conduct has the purpose or effect of interfering with an individual's academic or work performance, by creating an intimidating, hostile, offensive, or otherwise unacceptable educational or work environment.

The determination of what constitutes sexual harassment depends upon the specific facts and the context in which conduct occurs. Sexual harassment takes many forms: subtle and indirect or blatant and overt; conduct affecting an individual of the opposite or same sex; between peers or between individuals in a hierarchical relationship; between teacher and student. Regardless of the intentions or the actor, the key question is always whether the conduct is unwelcome to the individual to whom it is directed.

There are special risks in any consensual sexual or romantic relationship between individuals in inherently unequal positions (such as student and faculty, or junior and senior faculty). Relationships in which one party is in a position to review the work or influence the career of the other may constitute sexual harassment when that relationship gives undue access or advantage, restricts opportunities, or creates a hostile and unacceptable environment for others in the work or classroom environments. Furthermore, such relationships may be less consensual that the individual whose position confers power believes, because of the complex and subtle effects of that power. Moreover, circumstances may change and conduct that was previously welcome may become unwelcome. Even when both parties have consented at the outset to a romantic involvement, subsequent unwelcome conduct may constitute sexual harassment.

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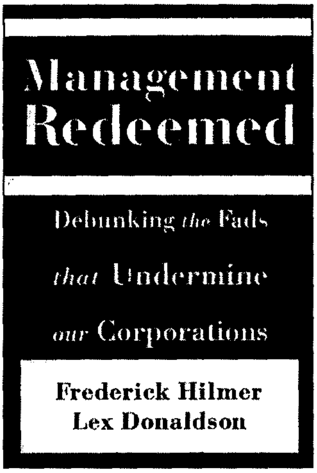

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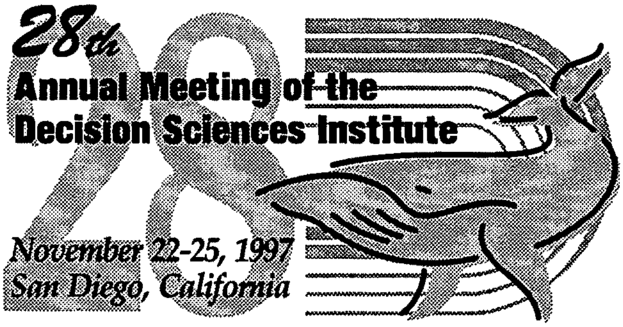

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The Decision Sciences Institute provides a forum for the sharing of technological advances across disciplines—and countries. The theme of the 1997 Annual Meeting (November 22-25, 1997) is "Global Integration of Technology in the Decision Sciences."

The interdisciplinary appeal of the Decision Sciences Institute's annual meetings has been widely recognized by researchers, managers, educators, and students from all areas of the business community. At the 1996 Annual Meeting in Orlando, over 900 papers, case studies, workshops, roundtables, and tutorials were presented in the study of decision processes in all disciplines of business adminstration.

Plan to submit a paper and join us for the pre-conference workshops and programs, as well as for presentations on research, teaching, and administration. Enjoy the benefits of networking with friends and colleagues in an intimate, professional setting. The meeting will be held at the San Diego Marriott Hotel & Marina.

The submission deadline for the 1997 DSI Annual Meeting is March 1, 1997. If you would like a call for papers, contact the Home Office, or visit the DSI Web site.

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The University of Virginia invites nominations and applications for the position of Dean of the McIntire School of Commerce.

The McIntire School of Commerce embraces Thomas Jefferson's concept of the "Academical Village" fostering close interaction between students and faculty. The McIntire School offers a B.S. in Commerce to approximately 640 full-time students, and an M.S. in Accounting and an M.S. in Management Information Systems to about 75 students. In addition, the McIntire School's executive development program educates managers from around the world. The McIntire School is ranked as one of the top 10 undergraduate business schools.

The primary responsibilities of the Dean are to provide academic leadership, foster external constituent relations, particularly fund raising, and render administrative leadership. The Dean reports directly to the Provost and the McIntire faculty.

The successful candidate should have demonstrated extraordinary leadership in a major university, business, or government organization. The candidate should be an advocate of the McIntire School's teaching, research, and service programs, as well as be committed to the mission of a research university. The candidate should be dedicated to the preservation of the McIntire School's high quality teaching programs.

Candidates should have an earned doctorate in a discipline appropriate to the School or significant executive experience. Applications from women and minorities are encouraged.

Review of applicants/nominees will begin immediately. Candidates should provide 3 copies of a letter of application and vitae, and the names of five references. The position is effective July 1, 1997. Address correspondence to Chair, Dean Search Committee for the McIntire School of Commerce, c/o Janet Greenwood, Heidrick & Struggles, 1301 K Street, N.W., Suite 500 East, Washington, DC 20005.

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Stanford University

SCHOOL OF ENGINEERING

Department of Industrial Engineering and Engineering Management

Center on Work, Technology and Organizing

FACULTY POSITIONS

Over the next two years, the Department of Industrial Engineering and Engineering Management (IEEM) at Stanford University anticipates two tenure-track positions in its newly established Center on Work, Technology and Organizing (WTO). The level of appointment is open. We invite both junior and senior scholars to apply. We expect to hire one new faculty member for the fall of 1997 and the other for the fall of 1998.

The Center on Work, Technology and Organizing seeks to generate knowledge, research and theory in the area of work, technology, and organizing. WTO will also develop educational programs on work and technology and serve as a nexus for an extended intellectual community of researchers from academia, industry and government who are concerned with issues of work and technology. Representative research areas that would fall within WTO's mandate include: the interplay between technologies and work practices; the relation between work practices and organization design; the consequences of a shifting technological infrastructure for cultural understandings of work; designers', managers', and workers' images of work; and research and development as a form of work. Although open to all research methods, WTO is strongly committed to field research, since we start from the premise that our knowledge of work in contemporary organizations is insufficient.

We are primarily interested applicants who study the intersection between work and technology in situ. We are less concerned with disciplinary background and, in fact, hope to build an interdisciplinary team. Experience in or familiarity with engineering, design or the physical sciences is expected and the individual selected will have a set of skills relevant to a school of engineering.

We encourage applications from active researchers who fit these general specifications, including organizational theorists, industrial engineers, behavioral and social scientists, and computer scientists interested in situated studies of human-computer interaction. Applicants should possess or soon expect to receive a Ph.D. We expect the individuals we hire to continue as active researchers and to be willing collaborators who are committed to building WTO into a vibrant intellectual community.

In addition to playing a central role in WTO, applicants will also have teaching and citizenship responsibilities in the Department of Industrial Engineering and Engineering Management. IEEM offers a unique environment for teaching and research in the context of an Engineering School. IEEM's faculty brings engineers together with social scientists around a curriculum that fuses production, operations management and engineering risk analysis with organizational behavior and the management of technology.

Interested individuals should submit a vita and samples of their work by December 15, 1996 to:

Professor Stephen R. Barley
Chair of the Search Committee
Department of Industrial Engineering and
Engineering Management
Terman 340
Stanford University
Stanford, CA 94305-4024

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University of Maine

Management Position

The College of Business Administration at the University of Maine invites applications for a tenure-track position in Organizational Behavior/International Management at the Assistant Professor level beginning September 1, 1997. Candidates must have a doctoral degree in business administration or offer substantial evidence that the degree will be completed by the time of appointment. Teaching experience is also desirable. Candidates must demonstrate an aptitude for successful teaching, research, and public service. Teaching responsibilities are nine (9) hours per semester of courses including organizational behavior and international management at the undergraduate and MBA levels. Send letters of application to: Professor Carol Gilmore, Chair, Search Committee for Assistant Professor of Management, 5723 Donald P. Corbett Business Building, University of Maine, Orono, ME 04469-5723.

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Dr. Y.S. Tsiang Professorship in Chinese Studies

THE UNIVERSITY OF MISSOURI-ST. LOUIS is pleased to announce the establishment of and a search to fill the Dr. Y.S. Tsiang Professorship in Chinese Studies. The scholar will be expected to play a leadership role in the expansion of Chinese Studies at the University of Missouri-St. Louis. The professor will be expected to take an interdisciplinary approach and exhibit, in his or her scholarship, both intellectual rigor and accessibility to a wide audience.

The first occupant of this professorship will be a faculty member in the School of Business Administration. The successful applicant may assume a position in any area of the School, including accounting, finance, management, management science and information systems, or marketing. The professor will teach courses in international business and the Chinese and East Asian business environment.

The professor will work closely with the Center for International Studies at the University to promote the expansion of Chinese Studies at the University and interest in China in the St. Louis community. The professor will also be an active participant in the Joint Center for East Asian Studies, a cooperative venture of the University of Missouri-St. Louis and Washington University.

Qualifications: Candidates must have a distinguished record of publication, teaching, and service in the fields of business administration and Chinese Studies.

Rank and Salary: Candidates must qualify for a tenured appointment at the rank of Professor or Associate Professor. Salary will be commensurate with the qualifications of the candidate; endowment funds will be used to support the research and outreach functions of the professor. Applications: The appointment will be made for Fall 1997. Review of materials will begin on January 1, 1997, though nominations and applications will be accepted until the position is filled. Applicants should include a letter describing how their background and experience prepares them for this important position. Applications should also include a curriculum vitae and names, addresses and telephone numbers of four references. (Candidates will be notified before references are contacted).

Please address application materials to: Dr. Y.S. Tsiang Professorship in Chinese Studies Search Committee, Dr. Joel Glassman, Committee Chair, Center for International Studies, University of Missouri-St. Louis, MO 63121-4499.

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UNIVERSITY OF ILLINOIS AT CHICAGO

The College of Urban Planning and Public Affairs at the University of Illinois at Chicago seeks applicants for full-time, tenured or tenure-track faculty appointments (rank open) for the fall semester of the 1997. Applicants must hold a Ph.D. in public administration, public management, or related fields. Teaching responsibility will be at the graduate level. The appointments will support the delivery of a NASPAA-accredited MPA program and a Ph.D. program in public administration.

At least two positions are expected to be filled, from among the following three areas:

1. FINANCIAL MANAGEMENT AND BUDGETING: We seek applicants with general training in public sector management, and with a strong background in public finance and budgeting. Demonstrated experience in applied budget analysis, e.g., cost-benefit and cost-effective analysis is also desired, as is staff or line administrative experience with a federal, state, or local agency.
2. INTERGOVERNMENTAL MANAGEMENT: Applicants should be qualified for research and teaching in federal-state-local relations and policy interventions. The strongest applicants will have special interest in urban/municipal management with, e.g., a human services, infrastructure, health, or other relevant management/policy specialization.
3. TRANSNATIONAL MANAGEMENT: Applicants should have general training in political economy and international relations, with a focused interest in management and policy issues surrounding the interface between multi-national corporations, government, and science and technology.

For full consideration, submit a letter of application, a vita, and three reference letters by December 15, 1996 to: George Beam, Search Committee Chair, Graduate Program in Public Administration (M/C 276), University of Illinois at Chicago, 1007 W. Harrison Street, Chicago, Illinois 60607-7137.

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CALL FOR AWARD NOMINATIONS

The Organizational Behavior Division of the Academy of Management announces its annual call for nominations for its "Outstanding Publication in Organizational Behavior Award." The award will be presented to the author(s) of a publication appearing during the 1996 calendar year in a recognized outlet generally available to division members.

The award is given for the most significant contribution to the advancement of the field of organizational behavior. Recipients of the award need not belong to the Academy of Management.

Each Academy of Management member may nominate one publication for the award; but, no member may nominate more than one publication. Nominations should be made in writing and must include: (*a*) a rationale justifying receipt of the award by the nominee(s), and (*b*) a full bibliographic citation of the nominated work. Self-nominations will not be accepted.

To receive consideration, material must be postmarked no later than March 31, 1997. The recipient of the award will be announced at the August 1997 Academy meeting during the OB Division's business meeting, where a certificate of recognition will be presented.

All nominations should be sent to: Dr. Ruth Kanfer, Department of Psychology, N478 Elliott Hall, University of Minnesota, 75 East River Road, Minneapolis, MN 55455.

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